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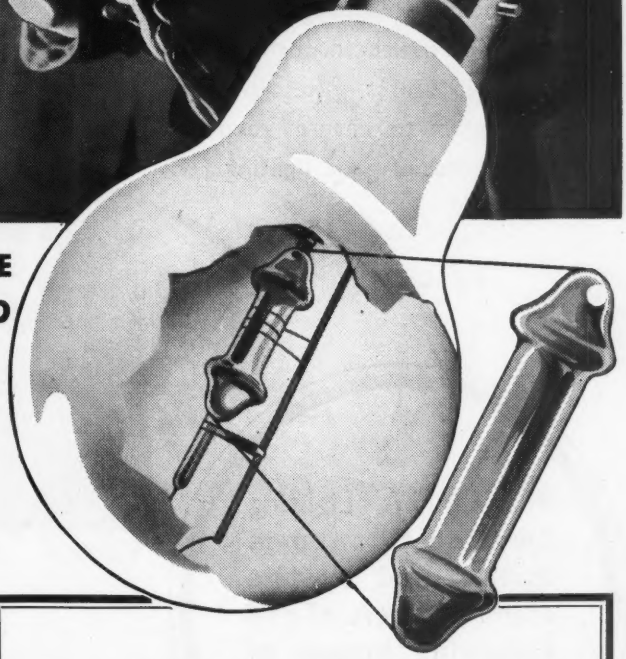

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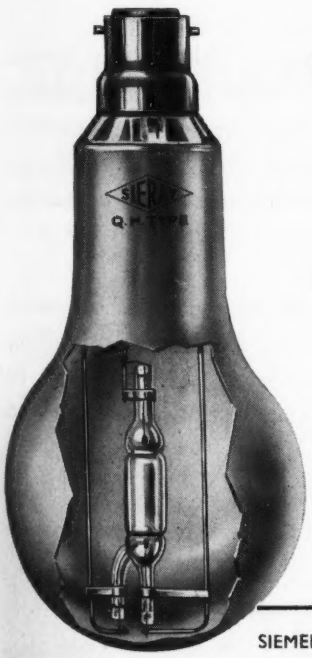

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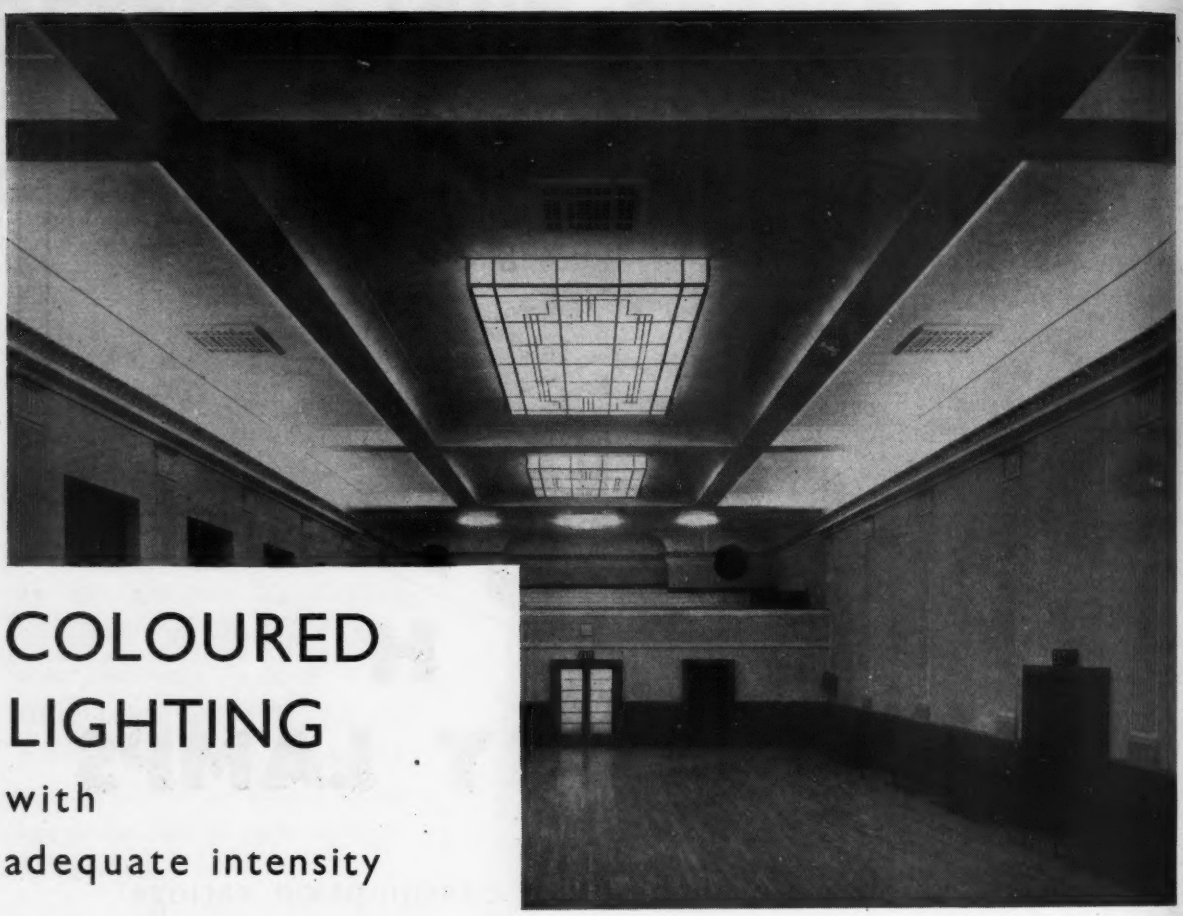

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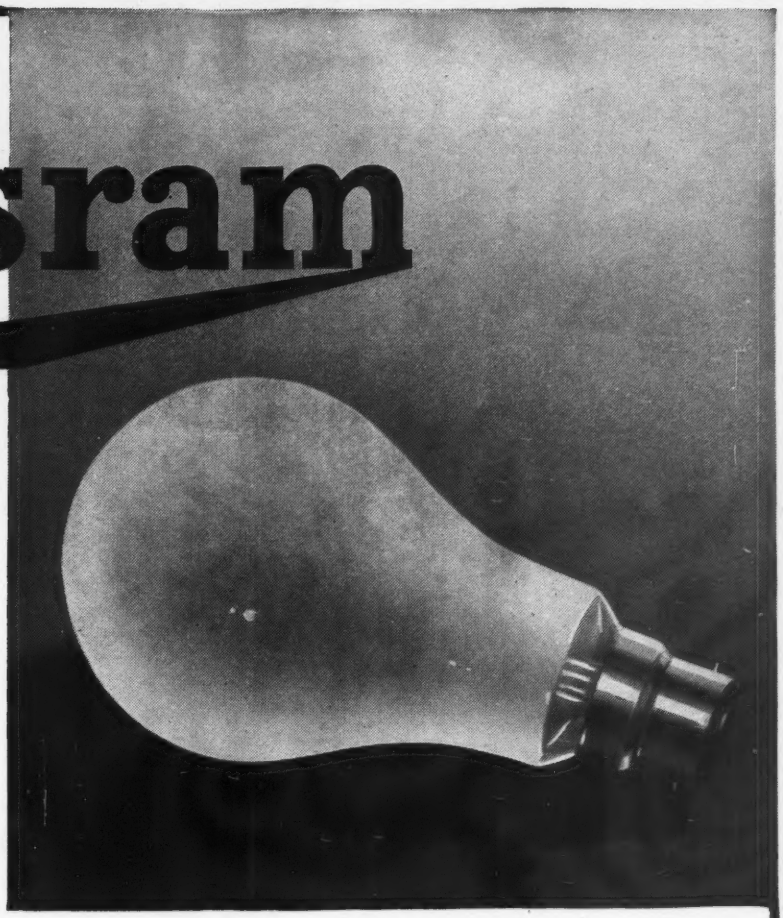

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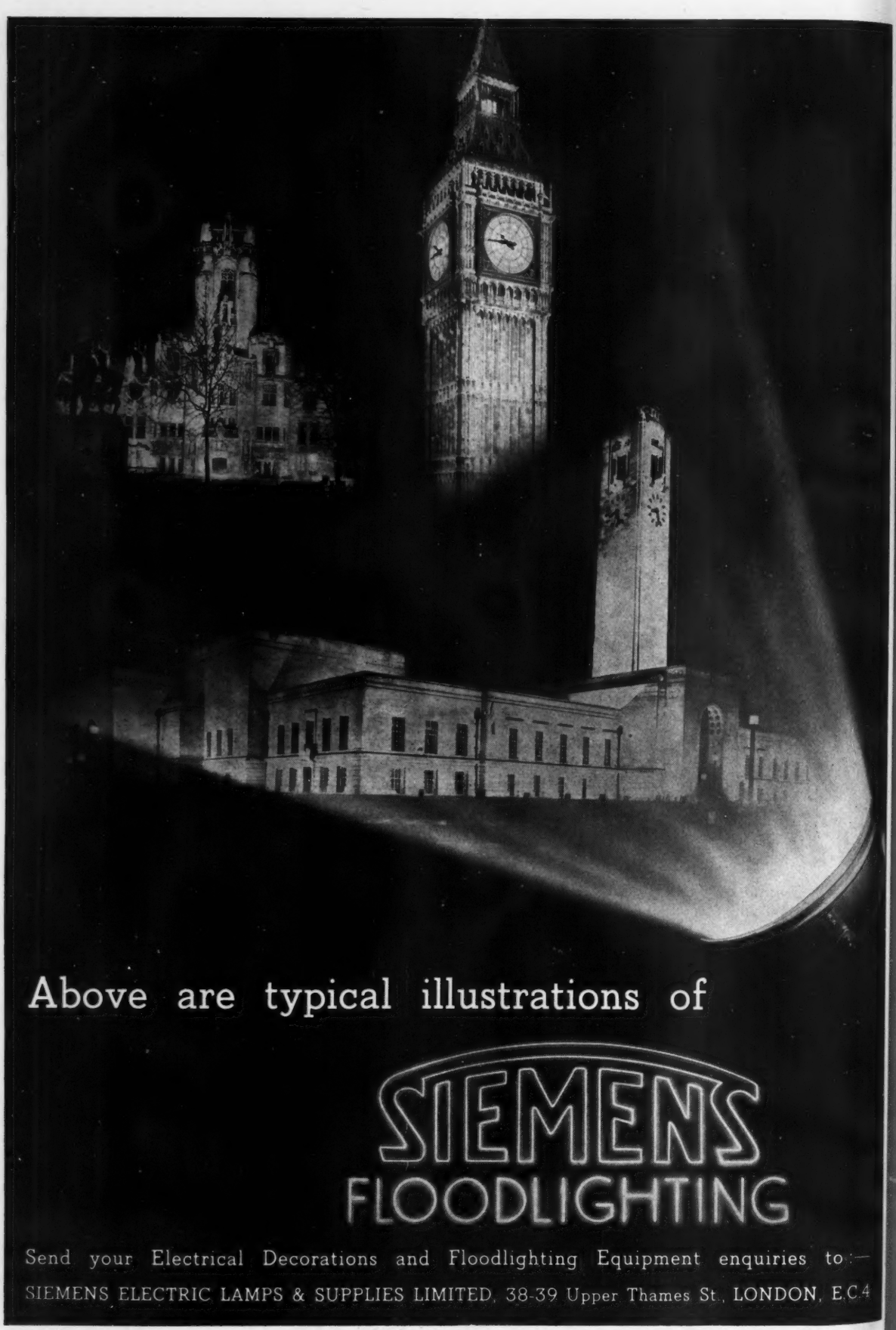
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Light and Lighting

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Say It With Light!

IT is but a few weeks now to the Coronation Festivities. The minds of many of us will go back a couple of years to the Silver Jubilee of King George V, to that brief halcyon period during which a spirit of peace and goodwill seemed to descend and each evening, after a day of golden sunshine, the silver spires of London's illuminated churches were seen outlined against the fading azure sky. Let us hope that next May the weather will aid us to capture something of the charm of those days.

Not a great deal has yet been said in regard to the illuminations, but it may be assumed that light will again be used to mark a great occasion, and that the floodlighting will be on an unprecedented scale.

In a way it is natural that the coming illuminations should be accepted as a matter of course. Londoners can hardly now be expected to evince the intense curiosity aroused by the efforts in 1931. They are rather coming to regard floodlighting as a natural means of celebrating great events. It might well become an established practice for the appearance of London—no mean city—to be thus enhanced by night.

Problems in Industrial Lighting

The second meeting of the newly formed Industrial Lighting Section of the Illuminating Engineering Society on March 24 struck exactly the right note. Each of the six problems was well presented, but not at too great length. Considering the proximity of the date to Easter there was a good attendance, and after the genial chairman (Mr. R. O. Ackerley) had ordered the front row of chairs to be reversed, so that authors might face the audience, there was a rapid fire of questions and some quite interesting points were raised. We must reserve to other issues accounts of some of the talks delivered by the speakers (Mr. T. C. Angus, Mr. E. L. Calvert, Mr. J. B. Carne, Mr. W. Imrie Smith, Mr. J. E. Lane, and Mr. L. M. Tye). Perhaps Mr. Tye's well illustrated account of the lighting of a printing works gave rise to most comment, but all were interesting. The apparatus, giving combined high illumination of small objects and intense illumination, shown by Mr. Lane, and the model illustrating the special requirements of lighting in the ceramic industry owing to the presence of dangerous dust (Mr. T. C. Angus) also excited interest, whilst Mr. Imrie Smith had to undergo a somewhat searching cross examination on his method of lighting motor car bodies for inspection.

Analysis by Means of Light

The series of addresses given at the Second Conference on Industrial Physics in Birmingham last month contained much of interest to the lighting expert. Mr. R. Donaldson's lecture on colour measurement and Mr. A. L. Whiteley's address on industrial uses of photo-cells covered ground quite similar to that treated in recent papers before the Illuminating Engineering Society. Of special interest was the former's appraisal of the photo-electric colorimeter, which would seem to simplify greatly the problem of colour measurement. There are, however, practical difficulties involved in the preparation of filters and the variations in behaviour of individual photo-cells, and it is still a question whether an accurate instrument could be produced at a reasonable price. Mr. Whiteley mentioned one very interesting recent development, the photo-electric pyrometer, based on the rapid increase in output of the caesium type of photo-cell when the temperature of the source is raised. Other developments included the application of the optical lever, recent simplifications in spectroscopes and their application to the testing of steels, the quantitative application of spectrographic methods—for example, in determining the amount of antimony in lead sheathing for aerial cables—and the application to such problems as cylinder wear and the mechanism of oil lubrication of that latest of all devices, the "electron diffraction camera."

Gas and Electricity in Graz

Almost every month, it seems, we receive notices of some conference. Last month we recorded the Illumination Congress (June 24-July 1) in connection with the Paris International Exhibition.

We now receive a notice of a conference to take place during April 22-24 in Graz, the second largest town in Austria. The coming conference is to be devoted to the joint consideration of the technique of gas and electricity supply, and receives the support of official bodies in Austria concerned with both questions. Visitors from Germany, Switzerland, Hungary, and Yugo-Slavia are expected.

It is pleasant to find engineers concerned with gas and electricity thus hobnobbing at a joint gathering. We commend the conference to our readers. Inquiries should be addressed: Geschäftsstelle der Tagung für Elektricitäts- und Gas-Wirtschaft in Graz (Osterreich), Postfach. 106.

Events of the Month.

April 6th. **Visit** of members of the Photometry Section of the Illuminating Engineering Society to the **Research Laboratories of Kodak, Ltd.** After Inspection of the Laboratories, a talk on **"Photographic Photometry"** by Mr. E. W. H. Selwyn. Train to Harrow and Wealdstone (Bakerloo). Arrive **6 p.m.**

April 13th. Mr. G. T. Winch and Mr. L. Jesty on **Television Images,** an Analysis of their Essential Qualities, followed by Television Demonstrations (*General Meeting of the Illuminating Engineering Society in the Lecture Theatre of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1*); **7 p.m.**

April 21st. Discussion on **The Design of Industrial Lighting Fittings** (*Meeting of the Industrial Lighting Section of the Illuminating Engineering Society at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2*); **6.30 p.m.**

Photo by "Rawood," Ltd.

The President (Mr. Arthur Cunnington) and Mrs. Cunnington are seen standing in the background. Mr. G. Grey Wornum is seated on Mrs. Cunnington's right, and The Dowager Lady Swaythling on Mr. Cunnington's left.

The Illuminating Engineering Society's Annual Dinner

This Annual Dinner, held at the Trocadero Restaurant (Piccadilly, London, W.1), at 7.30 p.m. on March 17th, was again an outstanding success, and, by general consent, justified its reputation of being one of the most agreeable annual functions of this kind in London.

THE annual dinner of the Illuminating Engineering Society, held at the Trocadero Restaurant on March 17, fully lived up to its reputation as one of the jolliest affairs of the kind in London. If no new records were broken the attendance was well up to standard, and was not unduly affected by the equally successful informal social evening arranged for the first time about a month previously.

Among the guests of the society were Mr. Asa Binns (President of the Institution of Engineers-in-Charge) and Mrs. Binns, Mr. Stephen Lacey (President of the Institution of Gas Engineers) and Mrs. Lacey, Mr. E. C. Lennox (President of the Association of Public Lighting Engineers), the Dowager Lady Swathling, Mr. A. E. Turville (Chairman of the Institute of Ophthalmic Opticians) and Mrs. Turville, and Mr. H. T. Young (President of the Institution of Electrical Engineers) and Mrs. Young.

Past Presidents of the society were represented by Mr. A. W. Beuttell, Lt.-Col. Kenelm Edgcumbe, Mr. C. C. Paterson, Mr. C. W. Sully, Mr. H. Hepworth Thompson, and Mr. D. R. Wilson.

"The Illuminating Engineering Society."

The usual loyal toasts having been honoured, the toast of "The Illuminating Engineering Society" was proposed by Mr. G. GREY WORNUM, F.R.I.B.A.

Mr. GREY WORNUM, in his opening remarks, congratulated the society on its impartial attitude towards lighting problems, and emphasised the importance of the purpose it served in affording opportunities of intercourse, not only to gas and electrical engineers, but to students, architects, and others interested in illumination. He discussed in some detail the trend of modern practice in illumination, remarking on the growing recognition of the possibility of combining good, practical features of lighting with artistic effect, and paid a tribute to the excellent work done by the E.L.M.A. Lighting Service Bureau in this connection. He recalled a tendency to concentrate on the design of the fitting itself and to exploit those of an unduly elaborate and expensive type. Nowadays, however, the fitting was considered less as a separate entity than as a part of the general architectural scheme. Mr. Wornum concluded by suggesting some new ideas in regard to the use of colour in decorative lighting, giving instances of effects associated with various colours, and dwelling on the psychological effect of different colours and the utilisation of such effects in the design of decorative schemes for dwellings.

THE PRESIDENT (Mr. A. Cunnington), in responding to the toast of "The Society," thanked Mr. Grey Wornum for the kindly way in which he had proposed the toast, and expressed the society's gratification at having him present with them as an indication of the necessary co-operation between the architect and the illuminating engineer. Mr. Cunnington also welcomed on behalf of the Council the many guests present representative of kindred societies and of the great industries connected with illumination.

The expansion of the society, which had been rather a feature of the present session, was, he thought, a natural outcome of the greater interest taken in lighting by people generally. He recalled

the stir made by the floodlighting of 1931, when the Illumination Congress was held in this country. That penetrated to very distant quarters—even the stationmaster of Little Slocombe-on-the-Mud wrote and asked to have his station "floodlighted," and pointed out that the electric mains passed over his station, unfortunately, however, not realising that the said mains were probably at 132,000 volts!

The formation of new sections had given rise to a doubt in some quarters as to whether the rapid expansion of the society might not lead us a little out of our depth, but personally he had no fear in this direction so long as the newly formed sections concentrated on the scientific and engineering aspect of the problems with which they dealt.

The society was beginning to branch out in another direction, and a determined effort had recently been made to start a scheme for education in illuminating engineering. Undoubtedly there was a very great need for a move in this direction.

The President referred to one amusing result of the "pocket courses" in illuminating engineering appearing in the *Evening Standard* and elsewhere, namely, a request (from one of the heads of a department on the railway, not in any way connected with the engineering side) for a light meter to be installed in his general clerical office, so that he might see that satisfactory lighting was provided for his staff! There was, however, some danger that light-meters might be applied indiscriminately and might occasionally become something of a nuisance.

He hoped that there would arise from the educational scheme, and the consequent improved status of the illuminating engineer, a general recognition that illuminating engineering is an exact science and not just a question of fixing various lamp fittings at random.

Mr. Cunnington concluded with a tribute to the honorary secretary. They all recognised that Mr. Dow and his small band of workers at Victoria-street represented the heart of the society, and they were to be congratulated on the able way in which they had managed to keep going in spite of the rapid development of the society's work.

"The Guests."

Dr. S. ENGLISH (Vice-President), in proposing the toast of "The Guests," remarked upon the wide range of interests represented. Some allusion had been made to the function of the society in affording a common ground for gas and electrical engineers. He would therefore first mention Mr. Lacey and Mr. Young, respectively Presidents of the Institutions of Gas and Electrical Engineers, but also both past members of the Council of the I.E.S., and both men of sterling worth! On a previous occasion the proposer of this toast had described gas and electricity as father and mother to the society, a comparison that led to difficulties. He would rather regard the I.E.S. as the centre of a constellation, with these two luminaries constantly chasing each other, but moving in their own orbits, whose movements led to continual activity in the form of more light.

The presence of Mr. Turville, of the Institute of Ophthalmic Opticians, and Mr. Sutcliffe, of the British Optical Association, was indicative of the common interest of their vocation with that of the illuminating engineer in the Better Light—Better Sight campaign. They were glad to welcome Mr. Asa Binns, the President of the Institution of Engineers-in-Charge, which had recently combined with the society in a very successful joint meeting, and Mr. E. C. Lennox, the President of the Association of Public Lighting Engineers, whose masterly handling of the conference at Cheltenham many of those present would remember.

Dr. English referred briefly to several new sections which the society had formed or was forming, devoted to industrial lighting, public lighting and decorative lighting—all indicating their consciousness of the need of keeping in close touch with kindred bodies.

Finally, he drew attention to the departure made by the society in linking this toast with the name of a lady, Lady Swaythling, in recognition of the opportunity for women in the lighting field. This was an innovation, but not a risk, for her reputation as a speaker was known, and he felt sure that all those present were looking forward to hearing her reply.

The DOWAGER LADY SWAYTHLING, in an entertaining and delightful speech—which inevitably suffers by condensation—conveyed the thanks of the guests for the hospitality of the society. Alluding to the somewhat inclement weather, she recalled the case of the old lady who said that she had always observed that if she lived through the month of March she also lived through the rest of the year! Lady Swaythling described the impartial equipment of her own home, in which candles, gas, and electricity, wood and coal fires all figured—and enabled her to be prepared for any emergency! She recalled the gradual development in decorative lighting, and contrasted the efforts made at the jubilees of 1887 and 1897 with those at our recent Silver Jubilee of 1935. She drew attention to the endless opportunities for lighting in the modern home—lighting with tubular lamps, sunshine and colour effects, spot lighting and concealed lighting, illuminated curtains, flowers, and vases—and for effects in the garden.

Lady Swaythling commented specially on progress in America, where a new career for women as "home lighting advisors" seems to be developing, and emphasised the educative effect of the use of simple light-meters in the home, school, and office.

At the conclusion of speeches the hall was cleared for dancing, which continued until midnight, a very agreeable interlude being the amusing and melodious entertainment by Sterndale Bennett and Fred Gregory at the piano.

Illuminating Engineering Society. Programme for 1937-38

The present Session terminates next month, and arrangements for the 1937-38 Programme are already being made.

Offers of papers by members are now invited. Papers embodying the results of original research are specially desired, but others of a general, descriptive, or statistical nature will also be welcome.

All papers read before the Society are eligible for the Leon Gaster Memorial Premium, which is awarded annually.

Diffusion and Shadows

In what follows we give a summary of the paper on the above subject read by Mr. Howard Long at the meeting of the Illuminating Engineering Society, held at the E.L.M.A Lighting Service Bureau (London), on February 23rd.

At the meeting of the International Commission on Illumination at Cambridge in 1931 "Shadows" formed one of the new subjects set down for study. Much work had previously been done, especially in Germany, where researches extend over many years.

For general lighting the illuminating engineer usually strives to minimise shadows. Yet there are visual tasks for which a directional light, producing shadows, is already regarded as necessary.

The subject may, therefore, be divided under these two main heads:—

(1) Where the maximum diffusion is the objective.

(2) Where the provision of shadows is the main requirement.

It was proposed by the British Committee at the I.C.I., Germany, 1935, that the degree of diffusion of an installation should be given by the expression:—

$$D = \frac{Ei}{E} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Ei = the illumination in the worst shadow.

E = the illumination without the shadow.

This, however, was not approved by the German Committee, who have done so much work in this field.

In Germany the shadow factor(s) or "shadiness" is given by the ratio:—

$$S = \frac{Es}{E} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where Es = the illumination from the fitting, which is shaded out = E — Ei.

E = the illumination without the shadow.

Cases for the Avoidance of Shadow.

Two main cases for the avoidance of shadow may be mentioned.

(a) Where work is done on plane surfaces, such as in clerical offices and drawing offices.

(b) where a shadow cast on the work (so that the brightness of the surrounding field is the greater) reduces seeing power.

The Value of Shadow.

Shadows of value are "Revealing Shadows," such as reveal the form of solid objects. Without them a uniform tone solid appears as a plane surface. With 100 per cent. Diffusion—which can only be obtained in an enclosure having the properties of an integrating sphere photometer—no shadows are possible. There is then a complete lack of form, provided the solid is of the same colour tone all over.

There are also "Revealing Shadows" which enable seeing, even with substantially plane surfaces. Many instances (such as "Braille" sheets and textiles) exist. In these cases a large direct (and oblique) component of illumination is useful.

Attainment of Diffusion.

The provision of Diffusion by general lighting enters into almost every installation, and is, therefore, of more widespread value than the provision of supplementary shadows.

The work of the British Committee (individually and collectively) has resulted in a clear understanding of the factors which control Diffusion, and has led to the following conclusions:—

(b) *Only when the classes of light distribution vary widely does the distribution have any appreciable effect on Diffusion.*

(c) *The wider the distribution the greater the Diffusion.*

(d) *The closer the spacing (with greater uniformity) the less the effect of light distribution.*

The Shadow Caster.

A condition of progress is naturally a method of measurement. As a rough guide to the diffusion obtained, the author has for several years measured the illumination (Ei) in the worst shadow cast on the work by any worker. A further measurement of the unobstructed illumination E then enables the ratio $\frac{Ei}{E}$ to be determined. This method is useless, of course, for a more detailed study of the subject as the human body is not a reproducible standard, and the light from a varying number of fittings is obstructed.

Several forms of shadow caster have been evolved, but none is yet standardised. That designed by Norden consists of a circular opaque disc about 13/16 in. diameter arranged about $1\frac{3}{4}$ inches above the comparison surface of a visual type portable photometer or above a photo-voltaic cell. The disc is movably attached to a wire bent in the form of a semi-circle and pivoted at the diameter of the curve. Thus the disc may be adjusted to any position of zenith and nadir.

To determine the Shadow factor $\frac{Es}{E}$ it is necessary to take two measurements, namely, Ei (in the shadow) and E (without the shadow), but instead of employing the direct ratio of these readings, Es (the illumination from the fitting shaded out) has to be found from the expression:—

$$Es = E - Ei \quad \ldots\ldots\ldots\ldots (3).$$

A valuable analysis of the illumination at any point is possible by determining the shadow factor

for each source contributing at that point. Thus, the direct and diffused components and the direction of the principal shadow (if any) are found. It is thus possible to allocate the cause of any depreciation of illumination due to walls and ceiling and the amount due to the sources.

Processes Where Some Degree of Shadow is Essential and a Direct Component of Illumination May be Necessary.

The British Committee has so far listed the following processes. Additions will be made from time to time:—

Inspection of cigarettes for filling; production of Braille books; "make-ready" for printing; marking and inspection of steel rules; laundries—classifying materials of garments; handling type—typesetting, mono-casting; file cutting; engraving; inspection of glass, polished metal, and tinplate (in this class extended sources are used); in all cases where it is desired to see irregularities; in virtually homogeneous surfaces of uniform colour; certain textile processes; leather grading; inspection of razor blades; inspection of fur. To this list hand sewing can now be added.

Physiological Aspects.

In the concluding section of the paper some account of the "Physiological Side of Shadow Engineering," and the influence of "contrast induction," as recently discussed by Dr. Norden, was given.

Demonstrations of Shadow.

In the course of the meeting instructive examples of the effect of oblique rays of light in revealing the nature of textile surfaces, patterned velvet curtains, embossed wallpapers, etc., were demonstrated.

In addition the ingenious and effective device was adopted of throwing on the lantern screen an image of the dial and moving pointer of a galvanometer, connected to a photometric photo-electric cell which could be applied to register the illumination at any point in the room. This method was applied to various combinations of fittings in order to illustrate the differences in diffusion with the spacing and the nature of the lighting unit.

(The attention of readers is also drawn to a special contribution (see p. 100) on Shadows, by Dr. K. Norden, who opened the discussion on Mr. Long's paper.)

Lighting Plans for the 1937 Paris Exhibition

It was a happy thought to arrange for the last of the series of Architects' Conferences on Lighting at the E.L.M.A. Lighting Service Bureau, on February 17, to be devoted to an account by Monsieur H. H. Maisonneuve of the plans for the lighting of the 1937 Paris Exhibition.

Mr. J. Y. Fletcher, in introducing the speaker, remarked that in France those in charge seemed to set themselves to discover the best and most beautiful lighting, and then somehow found the money to produce it. He felt sure that the Board of Management in Paris would not merely ask how much the lighting would cost and then cut down the figure by 50 per cent.—as had happened in this country!

M. Maisonneuve, in the early part of his address, recalled the progress shown at successive exhibitions during the period 1925 to 1935, and emphasised the intention in Paris to produce a harmonious scheme and avoid any clashing of lighting effects. He explained that 45,000 kw. would be devoted to the lighting, as compared with 18,000 kw. in 1931, and that the exhibition was being divided into three chief areas (the right and left banks of the Seine, and the avenues and gardens), each entrusted to the care of eminent architects, while special treatment was being given to the river itself.

The promenades beside the river, planted with trees, will make excellent subjects for decorative treatment. In the exhibition proper, forty-five nations are erecting their own palaces, and France will construct about twenty-two buildings. The lighting may be classified under four headings: (1) Interiors of buildings and halls, (2) outdoor façades, (3) the fountains, and (4) streets, gardens, and trees.

On the left bank of the Seine the Eiffel Tower (still the highest monument in Europe) will be illuminated by two sets of projectors, one composed of 800 projectors equipped with 1,000-watt lamps, the other of fifty searchlights equipped with super-pressure mercury lamps. There will be firework set-pieces on the platform of the tower, the apparent shape of which will be altered by means of lighting, and about 20 km. of luminous tubes will form a pattern of blue and rose festoons. The foliage of trees on the esplanades will be illuminated by mercury and sodium lamps, and promenades lighted by decorative standards of the indirect type.

The gardens on the right bank of the Seine will be illuminated in a restrained manner, but there will be many ingenious displays, some of which are to be in the nature of surprises. Spectators, for instance, will have the impression of a mass of running water luminous in itself. The Seine is to be ornamented by numerous illuminated fountains, the submerged mechanism of which will not interfere with ordinary river traffic, and from floating pontoons illuminated smoke, balloons, parachutes, etc., will be launched.

In the exhibition itself there will be many attractive lighting demonstrations, illustrating luminous phenomena, applications of ultra-violet light, typical modern lighting installations, etc.

Altogether an exhibition well worth seeing.

Practical Aspects of Precision Photometry

In what follows we give an account of the visit of members of the Photometry Section of the Illuminating Engineering Society to the Research Laboratories of the General Electric Co. Ltd. on February 22nd, when an informative address on Precision Photometry, illustrated by some very effective demonstrations, was given by Mr. G. T. Winch.

The gathering arranged, on the invitation of the General Electric Co., Ltd., at their research laboratory at Wembley, on February 22, when Mr. G. T. Winch gave an illustrated talk on the above subject, admirably illustrated the utility of the special sections which the Illuminating Engineering Society is now arranging Members of the photometry section turned up in force. They had an opportunity of discussing details of procedure in photometry such as can naturally only be rarely afforded at general meetings.

Inspection of the Laboratories.

On arrival at Wembley after 6 p.m., visitors were conducted in parties on a rapid tour of the photometric laboratories. In the short time available many things of interest were seen. One recalls particularly the assembly of varied lamps in the life-testing room, the very slick manner in which discharge lamps (after being allowed to heat up) are run in turn into the integrating sphere to be tested by photo-electric means, the photometers for measuring surface brightness, and the neat model by the aid of which the carrying out of this process and the plotting of brightness contours on plans of roadways can be demonstrated. Perhaps the most interesting item of all, however, especially after Mr. Guild's recent address on colorimetry, was the demonstration of a new colorimetric apparatus, based on the use of three photo-electric cells, equipped with appropriate colour-filters. By their aid it is possible to depict automatically on a screen the position in the Maxwell colour-triangle of any source of light investigated—a most ingenious and labour-saving device, but still in the experimental stage.

Mr. Winch's Address.

Visitors then assembled in the library, where an informative address, aided throughout by demonstrations, was delivered by Mr. G. T. Winch. This illustrated in a most striking manner the special utility of the photo-electric cell in photometry. By the aid of such a cell and a mirror-galvanometer, the existence of relatively small errors—revealed by the movement of a spot of light on a scale—could be demonstrated to the entire audience.

In opening his subject, Mr. Winch remarked that whilst there are available textbooks in which the theoretical aspects of photometry are treated *in extenso*, guidance on many practical details is seldom given. Many people familiar with theoretical requirements do not sufficiently appreciate the nature of the precautions necessary and the need for care when accurate results are desired. In most cases where discrepancies are thus caused, demonstration in a photometric laboratory has proved the quickest way of rectifying the trouble. Ordinarily it is only possible, in the laboratory, to show effects to one or two people. Mr. Winch explained, however, that by means of the highly sensitive photo-electric apparatus assembled (a universal form of photo-electric photometer developed at the G.E.C. laboratories) he hoped to demonstrate various effects which, a few years ago, could only be appreciated after years of experience in a laboratory.

Directional Candle-power Measurements.

The lecturer dealt first with directional candle-power measurements, and exhibited a typical standard photometric bench, a light-sensitive cell being, however, substituted for a photometer of the visual type. He pointed out the need for accuracy in the standards used in different laboratories which, however, could be periodically tested at the N.P.L., and for care in the use of electrical control apparatus—a 1 per cent. change in current through a tungsten filament lamp causing c. 4 per cent. alteration in its candle-power. Importance was attached to the preservation of good contacts, free from contact potentials (which may appreciably affect the operating pressure). A series of experiments illustrated the results of imperfect screening of the photometer head or photo-cell; it was shown that small adjustments might easily lead to changes of ½ per cent. or more. Sources of light have appreciable dimensions, and any uncertainty as to the exact position of their optical centres may affect measurements. For accurate work a ratio of 10 to 1 between distance and linear dimensions of source is desirable.

A specially interesting demonstration showed how small errors may be caused by slightly screening the bulb of an incandescent lamp, even though the filament is completely exposed, owing to the masking of portions of reflected images of the filament at the back of the bulb.

Lumen Measurements.

The next section of the address dealt with errors involved in taking polar curves of light distribution and measuring mean spherical candle-power or lumens. The need for a large number of measurements in deducing the m.s.c.p. of highly asymmetrical sources from polar curves was pointed out, and the precautions necessary in using integrating spheres and cubes with whitened interiors were discussed. (Cubes without corners were regarded as less accurate.) Such sources of error as the absorption of light by the lamp within the integrator and the effect of selective reflection properties of the paint for the interior were also briefly discussed.

Colour Problems

In dealing with visual photometry, Mr. Winch remarked that errors of observation must be added to those mentioned above. When there was no colour difference such errors were small, but in practice this condition is rarely realised. This was clearly illustrated by a device which enabled the appearance of the two fields of a Lummer Brodhun contrast photometer, illuminated by various sources, to be appreciated by the audience. Mr. Winch mentioned several devices, such as the use of special screens and solutions of known transparency, to eliminate colour difficulties and illustrated on the screen the effect of the flicker photometer, which was helpful when comparing light sources differing in colour, but apt to be somewhat fatiguing in practice. It was essential to use a flicker photometer of good design, such as the Guild pattern, and to operate it at a field-brightness of 25 eq. m.-c. or higher.

Photo-electric Photometers.

The concluding portion of the address dealt with photo-electric apparatus.

Here again the fundamental sources of error mentioned in the early part of the lecture might arise. In addition there were certain difficulties inherent in the method, such as fatigue of the cell or variation in sensitiveness with temperature. In the case of

photo-electric photometers using D.C. amplification, drift and instability had also to be considered. Photo-electric methods always depended upon a linear response on the part of the cell, which might not be exact under all conditions, and there was a possibility of error due to departure from true cosine response when the cathode was used as a test plate.

Further, there was the difficulty that unless the spectral sensitivity curve of the cell was identical with the I.C.I. " visibility curve," errors might arise whenever sources differing in colour were compared. In practice it was usually preferable to use photo-electric apparatus mainly for the comparison of sources of similar spectral composition; alternatively, if those of different type were compared, corrections might be applied. Theoretically, filter combinations giving an overall spectral sensitivity identical with that of the average eye could be used, but in practice this device was only approximate and was accompanied by loss of sensitivity and additional departure from the cosine law.

Discussion.

Before commencing the discussion the president (Mr. A. Cunnington) proposed a vote of thanks to Mr. Winch for his informative address and to the General Electric Co. Ltd., Mr. C. C. Paterson and his staff for their hospitality. He asked Mr. Paterson to open the discussion.

Mr. C. C. Paterson briefly expressed his pleasure in entertaining members of the Photometry Section. He congratulated Mr. Winch on his address and on his courage in attempting to deal with precision photometry with half the N.P.L. staff present! It was most interesting to him to return to his favourite subject of photometry, but he would leave it to others to carry on the discussion.

Dr. J. W. T. Walsh said that he rather favoured darkened walls in a laboratory because less expert skill in screening was then necessary. He referred to the difficulty in preparing a set of sub-standards without individual errors, which might not be entirely eliminated even by taking an average. Stepping up from, say, 10 c.p. to 40, 60, and 100, involved reliance on the inverse square law which, as Mr. Winch had shown, might involve errors owing to uncertainty regarding the position of the light-centre. Another source of difficulty was the formation of images in the bulb, which were difficult to locate and were specially objectionable if the source were small. Uncertainty might then arise through the formation—a pattern upon the photometer. In conclusion, he paid a tribute to the assistance of the lamp companies in enabling such good standard lamps as those available for use at the N.P.L. to be prepared.

Mr. J. S. Preston remarked that at the moment people were apt to regard physical photometry as the thing; later, however, there might be a reaction towards visual methods. As Mr. Winch had shown, physical methods enabled errors which one knew to exist in visual photometry to be readily demonstrated. Another instance of such an error was that caused by the obstruction due to one coil of a filament when slightly tilted out of its original position. Mr. Preston showed a lantern slide illustrating the qualities of a new filter which, in combination with a certain Elster Geitel photo-cell, gave a response curve very close to that of the average eye.

Mr. J. S. Dow emphasised the value of physical methods in demonstrating the existence of the many small errors inherent in photometry. Such a demonstration showed the futility of street lighting contracts in which penalties for variations of the order of one per cent. were imposed! Referring to the choice of dark walls and their depressing effect, he recalled one small and completely blackened photometer room which had been in his charge about thirty years ago and which was known amongst the students as "the black hole of Calcutta." He had found it possible, on occasion, to get remarkable consistency in comparing lights of different colour even by the equality of brightness method. But the meaning and value of such measurements—indeed, of all such tests in the laboratory—were doubtful when one considered how completely different might be the effect on the eye in the streets where very large areas of low brightness were observed. In conclusion, he recalled his early experiences when setting portable photometers by comparison with different standards at different laboratories in London. The apparent variations in standards were often surprising. At that time he had formed the habit of checking his instrument each evening by the known illumination on his study table at home—a method which was perhaps indefensible in theory but apparently quite useful in practice.

Mr. J. Ockenden described a method of smoothing out fluctuations in voltage by the aid of a special transformer which had proved most useful in the photometric laboratory. He pointed out that reflections from glass surfaces were almost completely polarised. Therefore any material which exercised selective transmission to polarised light should be excluded from the photometer head. As an interesting practical instance of the effects of striation on small sources he mentioned that striations in the atmosphere might render stars intermittently visible invisible, resulting in a trembling effect which was not apparent in the case of the larger planets. He believed that the fatiguing effect of the flicker photometer was due to the fact that only one eye was used. If both eyes were used the effect was not nearly so noticeable. He had under construction a flicker photometer with a binocular head.

Mr. S. S. Beggs inquired whether errors could not be reduced by the use of Talbot's variable sector disc. He was surprised that this method was not more widely adopted. There was a danger in relying too much on the accuracy of ordinary commercial portable photometers. Those of the physical type had, however, the merit of being free from personal bias. They should, therefore, command more confidence from such people as surveyors.

Mr. G. T. Winch, in reply, explained that in the G.E.C. laboratories light walls were preferred because other measurements besides those on the photometric bench were undertaken. By using screens and black curtains satisfactory accuracy could be obtained. In regard to sub-standards he recognised the difficulties mentioned by Dr. Walsh, but believed that if one took the mean of lamps calibrated at different times, the error that might arise was reduced. He was interested in the filter mentioned by Mr. Preston and would like to have fuller details in regard to constancy. He agreed with Mr. Dow that undue stress was often laid on the accuracy attainable in street measurements. In reality and accuracy, with portable street photometers within 10-15 per cent. was as good as one could expect. In regard to the problem mentioned by Mr. Ockenden—that of obtaining a constant voltage—batteries were used in the laboratory, but the same difficulty had arisen in the Osram lamp works. For operating commercial photometers in the works generator sets driven by synchronous motors had been found very satisfactory. These sets furnished a voltage constant over two or three minutes to within about 0.05 per cent., which was sufficiently constant for this class of photometric measurement. He would be interested to hear what success Mr. Ockenden had with his binocular flicker photometer. At present he had formed the impression that if one had to make a large number of measurements the flicker photometer was much more tiring than other types. Talbot law held very closely for rectifier cells. The variable sector disc, however, involved mechanical complications and was not a very handy thing to use

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Shadows

Their Value and How to Define Them

by

K. Norden

It is not very long ago that illuminating engineers regarded shadows as God-given phenomena, characteristic of certain forms of illumination and inconsistent with others. They now recognise that umbration, like illumination itself, can be treated by proper engineering methods, based on the research work on shadow done already by physicists, physiologists, and experimental psychologists. There is developing a system of proper design and control of shadows for their application in a practical lighting installation.

At the editor's invitation I will try to give, in a few lines, the essence of what I call "Shadow-Engineering."

The Shadow-Factor.

No effect can become the subject of any engineering science unless it can be made measurable; therefore the fundamental task of shadow-engineering must be to develop methods for measuring shadow.

First of all, the question arises—what is meant by measuring shadow? With shadow or umbration are implicated two measurable quantities: one is the illumination, which is left in the umbrated area after umbration has taken place and, therefore, may be denoted as "residue illumination"; the other is the "total illumination," which is the illumination of the same area before umbration has taken place or after it is past. Such measurements will be quite familiar to illuminating engineers, for either can be taken by any illuminometer or foot-candle meter, with its measuring plane arranged within the area concerned. The question is now whether and how the shadow can be defined by these two values.

If we analyse our conception of shadow we find that, primarily, it does not so much suggest the *positive* value of the illumination still prevailing in the shadow, as the *negative* value of that one taken away by the obscuration. The latter value may be described as "shadowed illumination." It is not directly measurable, but results indirectly from the measured values of "total" and "residue" illumination as the difference between them; it is one factor determining the intensity of the shadow, for the greater the shadowed illumination the more intense the shadow at a given level of illumination.

The reason why we conceive the shadow as obscuration rather than residue illumination is the fact that we instinctively associate and contrast it with the preceding or adjacent total illumination; thus shadow means to us not an absolute quality like illumination itself, but a relative one, and if we want to express the comprehensive value of shadow, the shadowed illumination must be brought into relation with the corresponding total illumination. If we denote the latter by E, the residue illumination by E_r, and the shadowed illumination by E_s, and if, as stated above, $E_s = E - E_r$, then the so-called "shadow-factor"

$$\frac{E_s}{E} = \frac{E - E_r}{E}$$

becomes the characteristic expression of shadow; it has been approved as such by the I.C.I. Through this factor every shadow is definitely determined as a proper fraction between the numerical limits of 1 (if E_r becomes = 0, i.e., no shadow cast at all) and 0 (if E_r becomes = E, i.e, total shadow). As both elements of which the formula consists—E and E_r—are directly measurable, the measurement of shadow has now its full definite meaning.

The definition of shadow by means of the shadow-factor, however valuable and handy for the use of illuminating engineers, is extrinsic only and does not fathom the true nature of the shadow. The inherent object of shadow-engineering, which is the appraisal of shadows, can only be ascertained by taking full account of their physiological and even psychological aspects.

Two Groups of Shadows.

When we set out to study the effect of shadow we are at first perplexed by the question how to reconcile the two contradictory facts, that shadows are on the one hand *obscuring* and *disturbing* as they obscure the working plane and upset normal seeing conditions, and on the other hand that they are

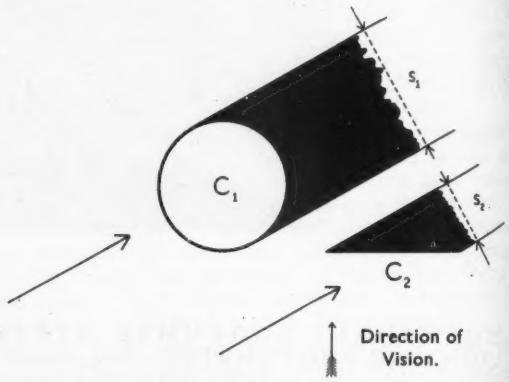


Fig. 1. Illustrating shadows which by the difference of their diameters reveal to the eye the plastic form of the rounded column C_1 in contradistinction to the flat shaped, painted column C_2.

revealing, as they aid us in getting a plastic view of form and depth, thus contributing to good seeing conditions. In reality there is no discrepancy, for these inconsistent properties belong to two groups of shadows of entirely different nature and origin.

Disturbing shadows (abbr. *d.s.*) are of a *passing nature*, as they are usually cast by *moving objects*, such as, e.g., movable parts of machinery or heads or hands of workmen; in fact, if they lasted for any length of time they would became irrelevant to illuminating engineers, for in such case the working place would doubtless be vacated! In contradistinction hereto, the group of revealing shadows (abbr. *r.s.*), which includes all shades or shadings, is characterised by their *permanent* nature, so that they become inherent feature of all *stationary* visual objects, indicating the spacial form and position thereof; the differentiation of our visual field which permits of the perception of details, is mainly due to this group of shadows.

From the contour of the shadow s_2 in Fig. 1 we can recognise at a distance the *outer* plastic form of the column C_1 as being cylindrical and distinguish it from a flat painted column C_2 in theatrical scenery, which would cast a shadow s_2 of much smaller diameter. The *inner* plastic form of an

Fig. 2a. Showing a revealing shadow which has the effect of making the stone more conspicuous.

Fig. 2b. Showing how the effect illustrated by Fig. 2a is cancelled by a disturbing shadow eclipsing the first one.

object is revealed by the varying intensity of the shadings depending on the inclination of the surfaces.

The beneficial effect of shading to our vision cannot be better explained than by the biological fact of "counter-shading" most common in the animal kingdom, which serves as a concealing or protective colouration. One example must suffice. If a caterpillar is lying at full length on a leaf, the cylindrical form of its body is indicated by the shading which makes the upper side appear lighter and the under side darker. But Nature has given to certain species of caterpillar a light colouration of the abdominal and a dark one of the dorsal part, with intermediate shades between, so that this counter-shading interferes with the perception of the solid body and produces the illusion of a dead thing entirely flat in shape, which will easily escape the notice of its enemies.

On the other hand, the opposite nature of d.s. is best illustrated by the case of a d.s. eclipsing a r.s. In Fig. 2a the shadow cast by the stone is a typical r.s., since it aids the discernment of the outer form of the stone, which otherwise would be less conspicuous, especially if it matches the colour of the ground; in Fig. 2b the same r.s. is temporarily overcast by the d.s. of a passer-by, with the consequence that the r.s. is obliterated as long as the d.s. lasts and its revealing effect is, for the time being, lost.

The ubiquity of revealing shadows and the indispensable aid they lend to our vision, account for the fact known to every illuminating engineer, that an illumination which is entirely free from shadows, even if its intensity is sufficient, is not desirable for fine or extra-fine work—for the objects assume a somewhat unnatural, blurred aspect, especially if they do not show much colour variety.

The foregoing observations make it clear that the two groups of shadows must be differently treated by the illuminating engineer. As to the disturbing shadows, in designing an illumination he must try to avoid or at least to minimise them; if this is not possible, he must see that the most intense d.s. is still kept *below* a certain permissible level. As to the revealing shadows, he must try to promote their formation and see that the least intense is still kept *above* a certain level. It is, therefore, one of the most important problems of shadow-engineering to determine the maximum or minimum levels of beneficial and disturbing shadow-factors.

The Nature of Shadow.

The conception of the shadow-factor is based on illumination intensities measured by photometrical methods, i.e., on physical quantities; useful as the factor is for characterising every shadow by a simple figure it is not meant to express any visual sensations of physiological or psychological nature involved in the shadow effect. Therefore, if we want to establish permissible levels of the shadow-factor, we must take into account how vision is affected by the shadow; in other words, we must compute the physiological value pertaining to a shadow-factor.

The study of the "physiological side of Shadow-Engineering" has shown that the total shadow effect is composed of three different phenomena.

Firstly: a shadow appears to us darker than would be accounted for by the measured value of its residue-illumination. This is due to the presence of the surrounding field of full unshaded intensity around the shadow spot, which induces an accentuating "contrast"-effect upon the shadow. We are able to compute the magnitude of this effect which increases in proportion to the shadow-factor: if e.g. an illumination of 20 foot-candles is umbrated at a shadow-factor=0.6 (i.e. a residue-illumination of 8 ft.-c. left), the obscuring contrast-effect amounts to 2.4—3 ft-c., leaving a "physiological residue-illumination" of only 5.3 ft.-c.

Secondly: colour sensations in the shadow are different from what they are with unshaded illumination. Every expert in photography knows that on the correctly exposed photographic plate, which is influenced by mere physical radiation, the shaded parts of an object appear too dark as compared to reality. This may be illustrated by Fig. 3, where the shadow cast on the re-entering angle of the doorway-wall makes the grey paint of the lower part appear

absolutely black, which is obviously false; in reality it might appear dark-grey but never *black*. This discrepancy cannot be explained by physical phenomena, as the stimulus exerted on our retina is due to the same physical radiation, as also influence the photographic plate; it must be attributed to a psychological effect alien to the plate, which is set up by our *inner* eye, making umbrated colours appear lighter, so that we may speak of a "whitening"-effect in relation to the photographic plate. On the other hand umbrated colours appear darker than they would without shadow, so that we may speak of a "darkening"-effect as well with relation to the perception of unshaded colours. This effect, though of entirely psychological nature, can also be objectively measured. At a shadow-factor=0.6, as in the above example, white colours turn light-grey and all grey shades dark-grey or even black.

Thirdly: the surrounding field of full unshaded illumination intensity around the shadow is liable to impair to a certain degree our visual capacity. At present we are unable to express this effect numerically, but we can feel confident at any rate that it is of only minor importance.

By computing each of these three factors and synthesising them, we obtain the "resultant" shadow effect and are enabled to determine whether or not a certain shadow-factor will be compatible with or favourable to any given conditions of illumination and kind of work to be performed. It is the aim of shadow-engineering to develop along these lines a "Code of Umbration" which shall supplement our extant Codes of Lighting.

Shadow Casters.

The purpose of the various Codes of Lighting in establishing standard levels of illumination-or shadow-values is twofold: first, to serve for the guidance of the designing engineer when he is laying out lighting plans for *future* installations, and, secondly, for criteria in checking up by measurements lighting conditions in *operating* installations. How in the latter case the measurement of the shadow-factor can be taken on the umbrated spot by mean of a foot-candle meter has been explained above. It simply means two subsequent illumination measurements. It does not, therefore, present any special problems, since in an operating installation the shadow to be measured constitutes a real quantity such as illumination itself. If, however, the designing engineer wishes to determine the values of shadows which will be cast in an installation only just planned by him, the data which permit of his predetermining the distribution and intensity of illumination will not suffice for the study of the shadows—because these shadows do not depend on conditions of illumination only, but also on the size and location of the object casting them.

The question is now whether reliable data on shadow-casters usual in practice can be furnished and their number restricted to only a few of special importance. The most frequent and important shadow casters in industrial and office lighting are the head and the right hand of the worker.

At first sight the choice between the innumerable sizes and possible locations seems almost hopeless. Scientific anthropometry, however, shows that average and extreme values are available which cover the great majority of individuals. On the basis of these figures we finally arrive at the following conclusions. For the purpose of determining the resultant shadow the *head* of a Central European worker can be substituted by a horizontal disc of circular shape, 920 mm. in diameter with males and 870 mm. with females, at a height of not lower than 380 or 350 mm. respectively, and the *right hand* of the worker by a horizontal disc of elliptical shape, its larger axis amounting to 180 mm. (males) or 165 mm. (females), at a height of 150 mm. From these casters the presumable shadow-factors can easily be computed and the illuminating design adapted to the requirements of the Codes regarding shadows. We are also enabled to foresee and to avoid the coincidence or the overlap of two or more shadows—which should never be admitted, as it would create chaotic conditions of illumination.

Fig. 3. Illustrating the well-known effect of shadows appearing too dark on the photographic plate as compared to reality (notice the shadows cast on the re-entering angles of the doorway wall).

The proper definition of the shadow-casting device is not less important for the problem of dissolving an illumination into its constituents by means of shadow casting. The human eye cannot distinguish whether an illumination is due to a number of contributing components or whether it is the result of but one single light source. The formation of shadows, on the other hand, does permit of such analysis, since each separate shadow corresponds to one distinct lighting unit, so that by measuring the shadow cast by a unit we can determine the contributed component of illumination.

In order to isolate completely the shadow of one light source without any accidental interference of others, we must employ a very small shadow-caster, i.e., one forming a very small visual angle, which has lately been determined as not more than 4°. To give an idea of this magnitude: the angle is subtended at a measuring plane of $1\frac{1}{2}$″ by a lighting unit of $3\frac{15}{16}$″ at a mounting height of 3.28 ft. above the plane. Since perfectly diffusing light sources do not cast regular shadows it is also possible by that means to separate diffused from direct illumination, and even to determine the light-diffusing quality of a given type of lamp or fitting. This, however, constitutes a brand-new branch of shadow-engineering still in course of development, and may be dealt with in this journal on some later occasion.

Road Lighting and Road Surfaces

In what follows we give a summary of the paper on the above subject read by Mr. G. H. Wilson at a meeting of the Institution of Civil Engineers (Manchester and District Association) on February 17, to which members of the North Western Local Centre of the Illuminating Engineering Society were invited.

The paper reviews the various factors affecting visibility in a street at night, and discusses the effect of the road surface, various materials for which are mentioned and briefly discussed.

STREET LIGHTING IN NEWPORT (MON.)
Commercial Street, Newport (Mon.), recently illuminated by G.E.C. Wembley non-axial asymmetric lanterns. For the complete installation 88 lanterns, 58 equipped with 1,000 watt Osram lamps and 30 with 500 watt lamps, are used. Lanterns are spaced 45 yards apart with a mounting height of 23 ft. 6 ins., and are in staggered formation, with a 3 ft. projection from the posts.

Of recent years strong emphasis has been laid on the visibility obtaining in a street by night and on its appearance, rather than on the illumination falling on its surface. Objects are seen by contrast, either of colour or brightness. With near objects both types of contrast occur, but with more distant objects brightness is the important consideration. Alike by natural and artificial light, objects in a street nearly always appear darker than their background. Objects seen by the aid of motor car headlights, on the other hand, appear brighter than their background, but the contrasts are in general much lower than those attained in a well planned lighting installation.

With a perfectly matt and white surface, such as is approached by snow or white blotting paper, one would expect that the brightness resulting from the use of a lighting unit would be closely in accord with the distribution of illumination, and would only gradually diminish from the brightest point. But with the dark materials used on modern roadways, which rapidly become polished by the action of traffic, matters are different. Local areas of darkness are liable to be formed if the light distribution is unsuitable. In general only a limited area can be rendered adequately bright by each lamp, the bright area being usually T-shaped, and the distribution of apparent brightness is very different from the distribution of illumination.

These considerations have an important bearing on the design of lighting units, their spacing and the height of mounting. Important factors governing the positions of bright areas on road surfaces are: (1) the distance between the sources (which should not be too great or dark areas will occur), (2) the mounting height which affects the width and length of the bright areas and the brightness of objects on the roads, (3) the spacing (which is less important), and (4) the light-distribution and quantity. The width between rows of sources should not exceed 30 ft. If the carriageway is wider an overhang is necessary. On wide roads three rows may be needed for good results. There is advantage in increasing mounting heights up to 25 ft., but no marked gain above this figure. Central mounting is liable to leave the margins of roads dark, except in narrow roads, and is seldom to be recommended. Similarly, single side mounting on straight roads is inadvisable, though on bends units should be mounted on the outside of the curve. A properly maintained lamp giving initially 18,000 lumens (e.g. a 400-watt h.p.m.v. discharge lamp for a 1,000-watt tungsten filament lamp) at 300 ft., spacing in each row should answer under all but the most adverse conditions. Under favourable conditions sources of half this power may be used.

Effect of Wet Weather.

So far consideration has been given chiefly to the results produced on an average street surface on a dry night. When the surface of the roadway is wet the bright areas become narrower and brighter and the remaining parts of the street darker. An installation which is thoroughly satisfactory for a dry street will answer reasonably well under wet conditions; but a "borderline" case may then become dangerously inadequate.

Streets in this country are frequently wet. In Sheffield it has been found that on one-third of the nights throughout the year the street surfaces are wet at lighting-up time. When it is actually raining the tendency is for the water to produce a mirror surface and narrow streaks of light. Some surfaces are rough enough to break up the water film and produce less narrow streaks. It is unfortunate that often the surfaces which give the best results when dry give the worst results when wet, but careful planning of the installation can do much to overcome this difficulty.

Desirable Qualities of Road Surfaces.

The practical merit of an installation is much affected by the road surface, so that the civil engineer, with whom the choice of material rests, may have almost as much to do with the final result as the lighting engineer. Reflecting properties of road surfaces have a great bearing on visibility, and merit as much study as wearing properties. An ideal surface has a degree of sheen intermediate between extremes, neither a mirror-like polish nor a rough matt finish. The properties of interest to the

lighting engineer include: (1) the surface sheen; (2) the general lightness of the surface; (3) the change with wear; and (4) the change when the surface is wet.

Practically any surface worn by traffic will show more or less surface sheen. Smooth, rough asphalt, much used in the City of London for its excellent wearing properties, takes a high polish, so that narrow, bright streaks are formed along the line from the observer to the lighting unit. At the other end of the scale is the rough surface dressing of dark, sharp chipping, closely packed in tar or bitumen, such that surface sheen is negligible, and the light-absorbing action very great.

Lightness of surface is desirable, but sheen plays a very much more important part. Gradual changes due to wear affect the reflection properties, but may take a considerable time. Thus, an asphalt road may take twelve months to reach a steady state. Such surfaces as wood block and granite sets change but little with wear, whilst concrete shows a significant improvement.

Characteristics of Various Surfaces.

In the final part of his paper Mr. G. H. Wilson briefly summarised the properties of a number of different road surfaces. In doing so he emphasised the fact that sheen is not associated with skidding. There is, in fact, little connection between the two.

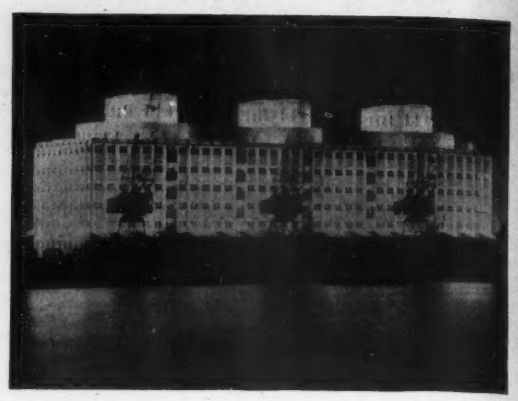
Compressed rock asphalt takes a high sheen and produces narrow, specular images. Under dry conditions it does not give as good results as some others, and it is liable to be flooded by rain, then giving very narrow streaks. Surface dressings consisting of *fine granite* or *limestone chippings* have a "sandpaper" texture. When worn and dry they have good reflection properties, producing large uniformly bright areas. In rain they flood rather easily, but they dry off rapidly afterwards. When dry the surfaces are grey and have a reflection factor of five to ten per cent. Their frictional and anti-skid properties are good. The thin coating of small chippings and binder applied to *wood surfaces* yields a good surface sheen when dry, but the older block surfaces may become dangerously "skiddy" when wet.

Concrete affords a surface with intermediate properties. When worn it has a high surface sheen. It is relatively light in colour, having, when new, a reflection factor of forty per cent. In wet weather smooth concrete is easily flooded, but this tendency may be diminished by rough screeding, which also increases the friction. *Stone sets* are light in colour and take a surface sheen, and the individual blocks with edges do not flood completely in rain. "*Two-coat*" and similar asphalts, when worn, give a very helpful sheen. *Tar-macadam* surfaces are also said to answer well, and to give bright areas not greatly different in size under wet and dry surfaces.

Various special "non-skid" surfaces have the drawback that, when new, their very roughness causes the surface to act as a light trap and makes it difficult to light them effectively.

When there exists a long-wearing surface, light in colour, non-skid, but able to take a surface sheen, non-flooding, and quick drying—the ideal surface for street lighting will have been approached, if not attained.

Thames-side Floodlighting



The picture above shows the appearance of the new granary and warehouse recently built by the Southern Railway on the river frontage at Nine Elms Railway Goods Depot. This great warehouse is seven stories high and 103 yards long. It is illuminated from all four sides, from the first floor upwards, by forty-nine 1,500-watt angle burning lamps spaced on the outer edge of the broad projecting canopy which extends all round the building. On the sixth floor, which is slightly set back, 500-watt projectors are used. The floodlighting scheme was designed by the consulting engineer of the Southern Railway, Dr. Oscar Faber, in collaboration with the Illuminating Engineering Department of the General Electric Co., Ltd., while the electrical installation was carried out by Messrs. Drake and Gorham, Ltd.

Lighting at the World's Fair in New York

At the moment one's mind naturally turns to the coming Coronation floodlighting in London, and the illumination of the International Exhibition in Paris, which is to be opened next month. Meantime, however, plans are going forward for another very important project, the 1939 World's Fair in New York. According to *The Times*, the fair as a whole is to radiate from a "Theme Centre," features of which are a slender triangular obelisk 700 ft. high (the "trylon") and a great white sphere 200 ft. in diameter (the "perisphere"), which will stand on eight pillars concealed by fountains. At night the perisphere will be lit by distant projectors in such a way as to appear to be slowly revolving on an invisible axis.

I.E.S. Glasgow Local Centre

We hear that the Glasgow Local Centre had a pleasant meeting in the Gordon Restaurant on March 4, when Mr. P. Freedman came up from London to present again his paper on Low Voltage Neon. The paper was much enjoyed by those present and led to a good discussion. A pleasant feature was the presence in the chair of Mr. S. B. Langlands, who readers will be glad to hear, has made a good recovery from his recent indisposition.

The Glasgow Local Centre has made good progress in its first session, about thirty-five local members having recently been added to the list. Mr. T. Catten, who as local honorary secretary was in a large measure responsible for these good results, has now returned to London, but his place has been taken by Mr. M. H. Hime at the Lighting Service Bureau of Scotland (29, St. Vincent-place, Glasgow), from whom all necessary particulars about the centre may be obtained.

Books Wanted

We have been asked to publish the following books which it is desired to obtain for the library of the Illuminating Engineering Society, now being assembled. The Hon. Secretary of the society would be glad to hear from any member or any reader of "Light and Lighting" who is in a position to present or offer for sale any of the books on this list. The library committee desires to take this opportunity of expressing their appreciation of the help of those members who have already donated books. Over 200 have thus been already collected.

HISTORICAL:—

Allemagne—*Histoire de la Lumière.*
Defrance—*Histoire de L'Eclairage des Rues de Paris* (1904).
Hunt, C.—*History of Gas Lighting* (1907).
Matthews—*History of Gas Lighting.*
Dredge—*Electrical Illumination*, 1882-1884 (2 vols.).

PHYSIOLOGICAL OPTICS:—

Helmholtz—*Treatise on Physiological Optics.*

PHYSICAL OPTICS AND LIGHT:—

Steinmetz—*Radiation, Light, and Illumination* (1918).

COLOUR:—

Abney—*Colour Vision* (1895).
Klein—*Colour Music* (1926).
Lovibond—*Light and Colour Theories* (1921).
Martin and Gamble—*Colour and Methods of Colour Reproduction* (1923).
Parsons, Sir John H.—*Colour Vision.*

X-RAYS AND U.V. LIGHT:—

Broglie, M. de—*X-Rays* (1925).
Rawling—*Infra-Red Photography* (1935).

ILLUMINATION (GENERAL AND ENGINEERING):—

Bloch, L.—*Grundzüge der Beleuchtungstechnik* (1907).
Lummer, O.—*Grundlagen und Ziele in Lichttechnik.*
Teichmüller, J.—*Moderne Lichttechnik in Wissenschaft und Praxis.*

PHOTOMETRY:—

Dobson—*Photographic Photometry* (1922).

LIGHT SOURCES:—

Ayrton, Mrs. H.—*The Arc* (1902).
Dye, F.—*Lighting by Acetylene.*
O'Connor—*Petrol Air Gas* (1912).

DAYLIGHT:—

Frühling—*Die Beleuchtung von Innenraumen.*

ARCHITECTURAL:—

Bryce—*Libraries, Public Exterior and Interior Lighting.*

SEARCHLIGHTS AND PROJECTORS:—

Nerz—*Searchlights, Theory and Application.*
Ribière—*Phares et Signaux Maritimes.*
Rey—*The Range of Searchlights* (1881).
Stevenson—*Lighthouse Construction and Illumination: Reports of the International Lighthouse Conference* (1933).

MISCELLANEOUS:—

Fuchs: *Stage Lighting* (1929).
Lambert—*Studio Portrait Lighting* (1936).
Whittaker—*Mines Lighting.*
Scholes—*Modern Glass Practice.*
Campbell and Ritchie—*Photometric Electric Cells* (1935).
Branard—*The Selenium Cell.*

GENERAL:—

The Encyclopaedia Britannica.
French and German Dictionaries and special guides giving technical terms in various languages.

Lighting Open Air Skating Rinks

Courtesy: The "Electrical Review."

We are indebted to Benjamin Electric, Ltd., for the above illustration showing the lighting of an open air skating rink at Wembley, illuminated by Duoflux floodlight units. This outdoor variety of artificially made ice rink is a distinct novelty, and the picture is, therefore, of general interest, apart from the lighting problem presented. The rink is provided by Alpine Rinks, Ltd., which provides an all-the-year load for refrigerating plant, formerly used only in summer, to meet the demands of the catering trade.

E.L.M.A. Coronation Design Course

The above illustration shows the audience assembled for the E.L.M.A. Coronation Design Course, to which we recently drew attention. From all accounts the course was more successful than ever this year—one factor that materially aided the lecturers being the evident advance in knowledge of lighting on the part of visitors as compared with a few years ago. The average attendance over the four days of the course was approximately one hundred.

In his concluding remarks Mr. W. J. Jones—who himself delivered three of the lectures and presided at nearly every session—strongly recommended all those interested in modern lighting to become members of the Illuminating Engineering Society.

Some Aspects of the Street Lighting Problem

The growing activities of the Illuminating Engineering Society have made exceptional demands on our space this month. The interesting paper on the above subject, read by Dr. S. English on March 9, and the supplementary paper presented by Mr. R. Maxted on the same occasion, are necessarily left over until our next issue, when we hope to deal with them fully.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from Page 79, March, 1937)

I.—RADIATION AND GENERAL PHYSICS.

74. Photo-electric Emission.

H. C. Rentschler and D. E. Henry. Frank. Inst., J., 223, pp. 135-145, February, 1937.

Advances have been made recently in the technique of producing photo-electric cells, resulting, firstly, in constant and reproducible response, and, secondly, in response to longer wavelengths than previously. The authors outline experiments and results having important bearing on the theories advanced regarding the increased emission from three activated surfaces. S. S. B.

75. Investigation of the Shenstone Effect.

Alfred H. Weber. Frank. Inst., J., 223, pp. 215-242. February, 1937.

The paper reports an investigation of the variation of photo-electric sensitivity of a metal as a function of electric currents passed through it. It is shown that the effect depends largely on the removal of occluded gases from the metal, and depends only on the heating effect of the electric current. The variations of outgassed molybdenum are attributed to the formation and evaporation of an absorbed electropositive gas layer. S. S. B.

II.—PHOTOMETRY.

76. Direct-reading Heterochromatic Photometry.

Marcel Laporte and F. Gans. Rev. d'Opt., Vol. 15, No. 10, p. 321, October, 1936.

Light from the gaseous discharge source is dispersed into its component radiations, and after each radiation is reduced proportionately to its coefficient of visibility, the light passes to a thermopile.

A comparison of the method with refined visual methods gave satisfactory results. R. G. H.

III.—SOURCES OF LIGHT.

77. Lighting and Electron Emission.

Anon. El. Rev., Vol. CXX., No. 3088, p. 169, January 29, 1937.

A summary of the present position of discharge lamp lighting, with notes on the photometry of coloured sources. R. G. H.

78. Super-pressure Mercury Vapour Lamp.

W. Elenbaas. Rev. d'Opt., Vol. 15, No. 10, p. 343, October, 1936.

A description, with diagrams, of the new super high-pressure mercury vapour lamps. Special reference is made to water-cooled lamps. R. G. H.

79. The Production of White Light Using a Single Luminescent Tube.

Anon. R. G. E., 41, pp. 138-140, January 30; pp. 172-173, February 6, 1937.

Combinations of electric discharge tubes of different colours have been made to give a good approximation to daylight colour. This article describes an attempt, claimed to be successful, to produce a reasonably white colour with one tube only. W. R. S.

80. A New 300-watt Mazda Lamp.

Anon. Magazine of Light, VI., No. 1, p. 14, January, 1937.

A new 300-watt lamp, with a shorter light-centre-length than normal, has been developed in America. The objective life is less than usual. C. A. M.

81. Group Replacement Cuts Lamp Outages.

A. F. Rehberg. El. World, 107, p. 580, February 13, 1937.

Comparative data are given for the Brooklyn Edison system over a period of four years, over the major part of which lamps were replaced on failure only, but later by group replacement. The very considerable decrease in lamp "outages" is emphasised. S. S. B.

82. Science and Electric Lighting.

C. C. Paterson. G.E.C. Journal, 8, pp. 92-100. February, 1937.

A verbatim report is given of a lecture given by the author to the British Association, September, 1936, dealing with developments in lamp manufacture during recent years. C. A. M.

IV.—LIGHTING EQUIPMENT.

83. The "Catchon" Downlight.

Anon. Magazine of Light, VI., No. 1, p. 11, January, 1937.

A brief description, with a photograph, is given of a light satin finish aluminium reflector fitting attached to the lamp. C. A. M.

84. Selection of Colours for Signal Lights.

Harry J. McNicholas. Frank. Inst., J., 223, p. 101. January, 1937; Bur. Stds., J. Res., 17, pp. 955-980, December, 1936.

Tests were made to determine the most suitable colour limits for low intensity signal lights for a six-colour system, of the colour glass and incandescent lamp type. Details of the tests are given and difficulties involved in the determination. The system favoured finally consisted of red, orange-yellow, white, green, blue and purple. S. S. B.

85. Optical Lenses Moulded from Plastic Material.

Anon. Nature, Vol. 139, No. 3512, p. 336, February 20, 1937.

A description of a demonstration of lenses moulded from a transparent resinous material, which can be produced more quickly and more cheaply than glass lenses. R. G. H.

86. G.-E. Synchrograph.

Anon. Magazine of Light, VI., No. 1, p. 2, January, 1937.

A brief description is given of a newly-developed device by which the opening of a camera shutter is synchronised with the flash of a photoflash lamp. C. A. M.

V.—APPLICATIONS OF LIGHT.

87. Progress During 1936.

H. W. Richardson. G.E.C. Journal, 8, pp. 4-6 and pp. 24-29, February, 1937.

Progress during 1936 in lamp development, photometry, interior and public lighting, floodlighting, and aerodrome and cinema studio lighting is recorded. C. A. M.

88. Developments in the Electrical Industry During 1936.

John Liston. G.E. Review, No. 1, pp. 5-66, January, 1937.

A section of this review is devoted to lighting developments during the past year. J. S. S.

89. Light and Architecture.
Anon. Am. Illum. Eng. Soc. Trans., No. 2, pp. 133-140. February, 1937.
Photographs and short descriptions of some architectural lighting schemes are given. J. S. S.

90. What is Wrong with Our 50-Foot-Candle Installations?
Ward Harrison. Am. Illum. Eng. Soc. Trans., No. 2, pp. 208-223, February, 1937.
Points out that the permissible brightness contrasts in interior lighting schemes decrease as the general brightness level is raised, and emphasises this point in connection with modern installations giving high illumination values. J. S. S.

91. Automatic Lighting Control Safeguards Children's Eyes.
Donald P. Caverly. El. World, 107, p. 542, February 13, 1937.
The author describes in detail a system of schoolroom lighting by which the illumination at the desk top is never lower than a chosen value (25 foot-candles), and is sensibly uniform throughout the room, the whole being automatically controlled. The proper use of window shades to eliminate daylight glare is stressed. S. S. B.

92. The Visibility of Various Type Faces.
Matthew Luckiesh and Frank K. Moss. Frank. Inst., J., 223, p. 77, January, 1937.
The authors have studied the relative visibility of various type faces, as determined by a visibility meter of their own design. The results are expressed both in terms of type size (points) for equal visibility under a given illumination, and of illumination necessary for equal visibility of a given size of type. For one type face the increase of illumination necessary to compensate for a smaller type size was also investigated. S. S. B.

93. Code of Highway Lighting—Committtee on Street Highway Lighting of the Illum. Eng. Soc.
Committee on Street and Highway Lighting of the Illum. Eng. Soc. Am. Illum. Eng. Soc. Trans., No. 2, pp. 141-160, February, 1937.
A specification for the planning of lighting schemes for roads with few intersections and little pedestrian traffic. An appendix summarises recent accident figures in the U.S.A. J. S. S.

94. Determination of Visibility on Lighted Highways.
K. M. Reid and H. J. Chanon. Am. Illum. Eng. Soc. Trans., No. 2, pp. 187-207, February, 1937.
An attempt to estimate visibility on highway lighting schemes is described. Three widely different installations were examined, and the results show substantial differences in visibility. J. S. S.

95. Highway Lighting.
Anon. Magazine of Light, VI., No. 1, pp. 12-13, January, 1937
A group of three further photographs of street lighting installations are given, together with spacing details. Lamps with bi-post construction in one instance and sodium lamps in another. C. A. M.

96. New Lighting for Fulham.
Anon. El. Times, 91, pp. 161-162, February 4, 1936.
The more important roads in Fulham have all been relit with high-pressure mercury-vapour lamps. The fittings are mounted on concrete poles at about 150-ft. spacing, and the results are said to be very good. Photographs are given. W. R. S.

97. A New Street Lighting Installation with Sodium-Vapour Lamps.
J. Wetzel. R.G.E., 41, pp. 186-189, February 6, 1937.
Describes, with diagrams of the fittings used, an installation of sodium lamps on the Pau-Bordeaux road in France. Photographs and data of the installation are given. W. R. S.

98. New Street Lighting at Bournemouth.
Anon. El. Times, 91, p. 187, February 11, 1937.
Gives photographs and short account of new lighting at Bournemouth. High pressure mercury-vapour lamps are used, with a colour modification due to tungsten-filament lamps. W. R. S.

99. The Usage of Refraction and Reflection in Street Luminaires.
T. W. Rolph. Am. Illum. Eng. Soc. Trans., No. 2, pp. 161-186, February, 1937.
The mechanics of vision by night in the street is discussed, and desirable light distributions are suggested. The characteristics of different methods of light control, and their application to various types of installation, are treated in detail. J. S. S.

100. Lighting at Tir John Power Station.
Anon. El. Times, 91, p. 275, February 25, 1937.
Gives details of the lighting equipment (chiefly prismatic glassware) used in the new power station at Swansea. Photographs are also given. W. R. S.

101. Lighting of Colston Hall, Bristol.
Anon. El. Times, 91, p. 196, February 11, 1937.
A photograph of the newly lighted Colston Hall is given, with a description of some of the fittings used. Wall and ceiling prismatic panels were very largely used. W. R. S.

102. Lighting in Experimental Tramcar.
Anon. El. Times, 91, p. 259, February 18, 1937.
Brief account, with a photograph, of a system of built-in lighting units in a Glasgow Corporation experimental tram. W. R. S.

103. Progress in Light.
Anon. Elec. Journal, Vol. 34, No. 1, p. 34, January, 1937.
Describes, with photographic illustrations, some floodlighting and fountain lighting installations, and also the warning beacon system on the San Francisco-Oakland bridge. R. G. H.

104. Coronation Illuminations.
Anon. El. Rev., Vol. CXX., No. 3,088, p. 167, January 29, 1937.
Describes, with photographs and diagrams, some new floodlighting units with special features. R. G. H.

105. Paris Exhibition Illuminations.
H. H. Maisonneuve. El. Rev., Vol. CXX., No. 3,093, p. 361, March 5, 1937.
A report of a paper on the special installations contemplated for the 1937 International Exhibition in Paris. R. G. H.

106. Continental Decorative Lighting.
Anon. El. Rev., Vol. CXX., No. 3,087, p. 131, January 22, 1937.
Describes, with photographs, illuminations at Brussels Motor Show, and an illuminated fountain, the largest in France of its type, at Port de Saint Cloud, in Paris. The projectors are placed in the fountain itself, the water serving to cool them. R. G. H.

107. Aerodrome Wind Indicator.
Anon. World Power, 27, p. 36, February, 1937.
Reference is made to a 22-ft. long electrically-lighted wind indicator installed at an American aerodrome that can be seen at a height of 15,000 ft. C. A. M.

108. Pelota Hall.
Anon. Magazine of Light, VI., No. 1, pp. 22-23, January, 1937.
The lighting of a hall in Madrid for the playing of pelota is described, and forms an interesting example of how the problems of illumination for similar ball and wall games can be solved. C. A. M.

109. Mazda Lamps Light and Heat Hotbeds with Improved Results.
L. C. Porter and J. P. Ditchman. Magazine of Light, VI., No. 1, pp. 15-17, January, 1937.
A summary is given, with photographs, of growth of seedlings with light and heat from incandescent lamps with, in some instances, heating cable in addition. C. A. M.

110. Luminescence and its Applications.
Anon. El. Times, 91, pp. 159-160. February 4, 1937.
Summary of a paper read before the Royal Society of Arts by J. T. Randall. A brief theory of the phenomenon of luminiscence, and an account of some applications, particularly to the production of light. W. R. S.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 459,683. "Improvements in or Relating to Illuminated Signs."

British Celanese, Ltd. December 18, 1934. (*Convention, U.S.A.*)

This specification covers an illuminated sign comprising two layers of an organic derivative of cellulose, such as cellulose acetate, placed together with electric discharge tubes located between the layers in grooves formed in one or in both of the layers.

No. 459,953. "Improvements in or Relating to Reflectors."

Wendel, R. August 2, 1935.

This specification describes a lamp structure for illuminating an area, such as a ceiling or floor, approximately uniformly which is open at the top (for illuminating a ceiling) to enable direct light from the light source to illuminate the area in the vicinity of the lamp structure. The structure includes two reflectors arranged upon opposite sides of the source, one of the reflectors being curved so as to direct the reflected light beyond and to one side of the directly illuminated area, while the other is curved and positioned so as to direct light falling thereon substantially wholly upon the first-mentioned portion of the reflector which re-directs that light to the more remote areas to be illuminated whereby a stronger beam is reflected towards such more remote areas. The first portion of the reflector may be an ellipsoid other than an ellipsoid of revolution. The second reflector may be spherical with its centre at the light source.

No. 460,012. "Improvements in or Relating to Light-Sensitive Layers for Photoelectric Cells."

Zeiss Ikon Aktiengesellschaft. August 8, 1935. (*Convention, Germany.*)

According to this specification a light-sensitive layer for photoelectric cells is made by vaporising a layer of caesium or rubidium on to a layer of antimony or bismuth, and then causing the metals to alloy with one another as by subjecting them to a heat treatment.

No. 460,122. "Improvements in Lamp Reflectors."

Dietrich, F. R. June 24, 1936.

This specification covers an improvement in or a modification of a reflector covered by Dietrich's prior specification No. 454,131.

The reflector comprises a series of parts having a common focus, the part at the apex having a greater focal length than the other part or parts nearer the aperture. The junction between the apex part and that adjacent thereto is in front of the focus. Each part may be paraboloidal or the parts may be ellipsoids with their point of convergence outside the reflector.

No. 460,124. "Improvements in Electric Discharge Lamps."

The British Thomson-Houston Company, Limited, and the General Electric Company, Limited. September 26, 1935. (*Convention, Germany.*)

In order to overcome the results of wandering of a constricted column discharge lamp when used for projection, the lamp is associated with an opaque sheath pierced by a slot of which the width is less than that of the constricted luminous column and the length is parallel to the mean position of the column.

No. 460,617. "Improvements in and Relating to Light Apparatus for Signalling, Advertising, and the like."

Holophane, Ltd. April 11, 1935. (*Convention, France.*)

This specification describes an arrangement for lighting of a plurality of zones or openings in a panel for signalling, advertising, or the like, in which a light source adjacent to the panel is surrounded by a lens or lenses close to it, so that substantially all the light from the source passes through the lens or lenses and is concentrated in parallel pencils on to reflecting surfaces opposite each of the zones or openings of the panel.

No. 460,665. "Improvements in and Relating to Optical Projection Apparatus."

Craggs, W., and Ogden, C. August 3, 1935.

This specification describes a construction of liquid heat filter for use in the light beam of an optical projector comprising an open ended body having passages through its wall for the flow of liquid and equipped with end closures constituted by removable parallel faced sheets of heat resisting glass secured in the open ends of the body by apertured clamping members detachably secured to the end faces of the body.

No. 460,666. "Improvements in or Relating to Vehicle Lamps, Searchlights, or the like, for the Penetration of Fog."

Underwood, L. R. May 28, 1935. (*Divided from No.* 457,443.)

This specification covers a lamp emitting a concentrated beam in which all the light emitted by the lamp bulb and concentrated by a reflector is polarized in substantially horizontal planes so that light vibrations are in the vertical plane, or nearly so, whereby, it is stated, back glare in fog is substantially eliminated. The polarizer may comprise a stack of transparent sheets having reflecting surfaces, directing prisms being disposed on the front and back of the stack respectively to direct the light on to the stack at the right angle to secure polarization and to render parallel to the initial direction the issuing polarized light.

No. 460,743. "Improvements in Illuminating Devices Comprising Mercury-Vapour Discharge Tubes."

N. V. Philips' Gloeilampenfabrieken. March 22, 1935. (*Convention, Germany.*)

This specification covers a mercury-vapour discharge tube for giving high surface brightness for projection, etc., in which the tube has a pressure above six atmospheres, and is so loaded that the contracted discharge has a surface brightness of at least 1.500 C.P./Cm^2. The tube is cooled so that the inner side of the wall of the discharge vessel has a temperature below bright red incandescence. The etching of the interior of the tube, normally found in constricted discharge tubes, is thus minimised.

The Coming Coronation Lighting

Important Buildings in London to be floodlighted by electricity—St. James's Park to be again floodlighted by gas—practically every Town Hall in Gt. Britain to be illuminated—over £2,000,000 to be spent on Floodlighting and Illumination Equipment.

According to all accounts, the Coronation lighting next month will be on an unprecedented scale. An increased load of about 100,000 kw. is expected. It is also estimated that some five million extra lamps will be used for decorations, and that 100 million units of electricity (mainly supplied free of charge) will be consumed. Something like £2,000,000 will be spent on floodlighting and illumination.

We have not any definite figures in regard to gas lighting, but we give elsewhere (see p.114) some notes on what is being done, and we are glad to observe that the gas floodlighting equipment, which did such good service in St. James's Park, London, during the Silver Jubilee celebrations, is again being installed.

London will again be the brightest city. Many important buildings in Central London, such as Buckingham Palace, the National Gallery, Westminster Abbey, St. Paul's Cathedral, the face of Big Ben, and its tower, and the Admiralty Arch, will again be illuminated. In the City of London, the Mansion House, the Guildhall spire, the Monument, the figure of Justice on the Old Bailey, and many other buildings will receive treatment. The Port of London Authority will deal with the floodlighting on the river. All naval dockyards and practically every town hall and municipal building throughout Great Britain will be floodlighted.

Fig. 1. A view of Westminster Abbey, as illuminated by Holophane, Ltd., during the Silver Jubilee Celebrations in 1935 and previously during the 1931 I.C.I. gathering.

We hear that the floodlighting of Westminster Abbey by Holophane, Ltd., will follow much the same lines as for the Jubilee (except as concerns the lower part of the building now obscured by stands). King Henry VII. Chapel will be floodlighted from the ground and on the clerestory level upwards. The north front of the Abbey, the north front entrance, and the north side west towers are also to be illuminated. Other installations in which Holophane, Ltd., are interested are the Princes-street frontage and the Bank

Fig. 2. Floodlighted Banners in Bond Street. A demonstration of this effect, which is planned for the Coronation period next month, was recently carried out by the General Electric Co. Ltd.

Fig. 3. The Tower Bridge, as first illuminated by Siemens Electric Lamps and Supplies, Ltd., in connection with the International Illumination Conference of 1931.

Fig. 4. The floodlighting of the Admiralty Arch, as carried out by the British Thomson Houston, Co., Ltd.

Fig. 5. A pleasing B.T.H. Coronation illuminated device, available in two sizes. The flag, tassels and spears are of sheet metal finished in various colours. The crown is moulded in weather resisting composition and contains pearl lamps and a metal reflector flooding on to the front of the spears. Mazda Pygmy lamps are used to outline the crown and cypher.

of Scotland in Edinburgh, St. Albans Abbey Tower and Gateway, Hornsey Town Hall, and Denbigh Castle, North Wales.

Some hundreds of cathedrals and churches throughout the country are being illuminated, and in many towns and cities special local efforts are being made. For example, at Haslingden buses are being decorated and lighted; at York the bars of the main city are being picked out by the aid of decorative lighting; Cheltenham is floodlighting the promenade trees with mercury electric discharge lamps and using amber lamps along each side of the road; Bedford is ornamenting an island with an illuminated waterfall with changing colours and fairy lamps among the trees. It has been suggested by the British Electrical Development Association that the contribution of communities to the celebrations might well take the form of permanent improved lighting over a road, main street, or public square. A number of authorities are adopting this suggestion.

The Empire is also taking its share. Durban is spending £5,000 on decorations and illuminations. Hong Kong power station will be floodlit in red, and all the principal buildings outlined in electric lamps. Singapore is using 40,000 electric lamps for private and public illumination schemes. Johannesburg, Adelaide, Ottawa, and other Empire cities will also floodlight their public buildings.

Apart from the efforts of local authorities, the use of decorative lighting by business concerns and private residents is likely to be a special feature of the

Fig. 6. A G.E.C. window illumination box with luminous front panel written GR and papier mâché crown behind. Designed to take one 75-watt Pearl Osram lamp.

celebrations. We illustrate a few typical devices taken from recent catalogues. Efforts by householders will probably be on a much greater scale than in the past. Manufacturers have made efforts to meet their needs, both by furnishing novel luminous decorations and by introducing simple and inexpensive forms of floodlighting equipment.

Figs. 7 and 8. Two Siemens Coronation devices.

On the left is a G.R. kaleidoscope equipped with flashes which cut in and out the various combinations, forming different shapes and colours.

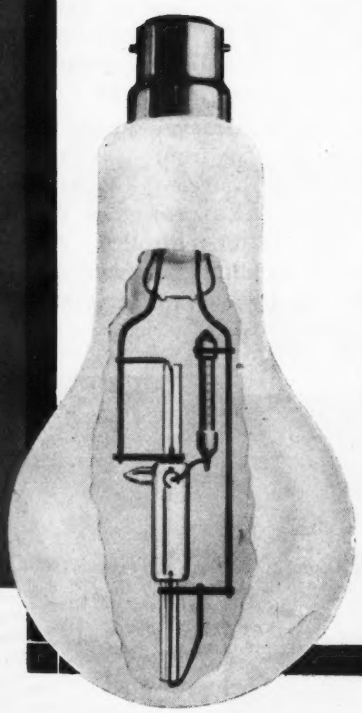
On the right is an illuminated display panel. The centrepiece is outlined with opal architectural and sprayed white vacuum lamps. The central portrait may be of Her Majesty the Queen if desired.

MAZDA MERCRA

80 w. and 125 w. LAMPS

For the first time Electric Discharge Lamps of low wattage are available in bulbs of the same shape and size as standard Gasfilled Lamps. These new lamps have the characteristic high efficiency of the larger Mazda Mercra Lamps, but can be used in lighting equipment designed to accommodate 150 watt and 200 watt Gasfilled Lamps.

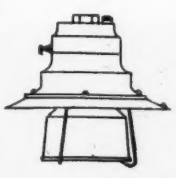
The arc, which is extremely concentrated, passes between two special activated cathodes, one of which is associated with an auxiliary electrode to facilitate starting. While the operating characteristics are, in general, similar to those of the high wattage lamps, both the running-up time and cooling time are reduced.



A further advantage is that these new lamps can be burnt in any position. It is necessary to operate these lamps with correctly designed BTH Chokes, and if desired, condensers can be used to improve the power factor.

The 3-pin Bayonet Cap prevents the lamps from being accidentally inserted in an ordinary lampholder.

WATTS	A.C. VOLTAGE	INITIAL LUMINOUS OUTPUT	PRICES s. d.
80	230/260	3040	30 0
125	" "	5000	35 0



BTH County Junior Lantern specially designed for street lighting, employing an 80 watt or 125 watt Mazda Mercra Lamp.

M3706

B T-H

THE BRITISH THOMSON-HOUSTON CO., LTD.

Figs. 9 and 10.

Two out of a considerable variety of "Hailware" colour-decorated glass globes, listed as suitable for the Coronation festivities.

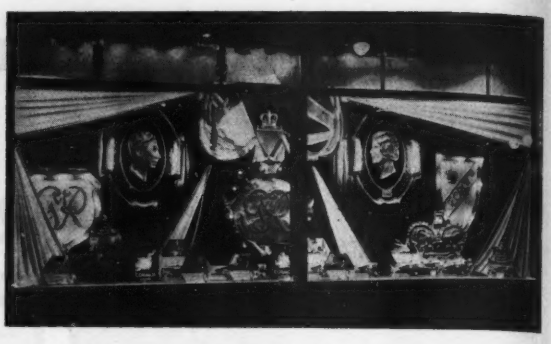
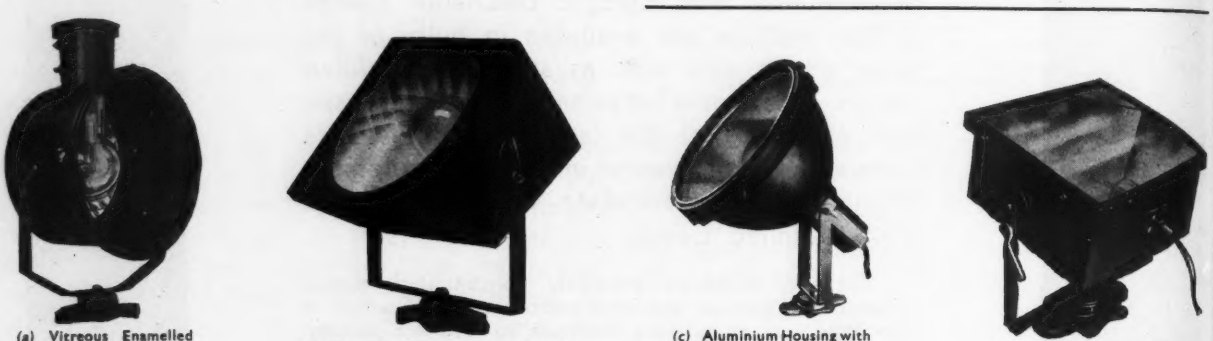


Fig. 11. The accompanying photograph sent us by Metro-Vickers Electrical Co., Ltd., shows an interesting display of Cosmos Coronation emblems and lamps in a showroom window of the Rochdale Corporation Electricity Department. The royal portraits on the plaques are reproduced from bas reliefs executed by Mr. Hastings, the well-known sculptor. The plaques are illuminated by side lighting and the other emblems are inset sign-type coloured lamps.



(a) Vitreous Enamelled Housing and Reflector giving 80°—90° beam.

(b) Sheet Steel Housing and silvered glass reflector giving 90° beam.

(c) Aluminium Housing with Reflector giving 100° beam spread.

(d) Long Range Special Type Projector.

Fig. 12. Types of Kandem Floodlight Projectors.

Catalogues of all the leading firms include illustrations of floodlighting projectors, now available in great variety. Our next illustration (Fig. 12) relates to a series described in a recent list issued by Kandem Electrical, Ltd. Of those here illustrated (a), (b), and (c) are of the wide angle type. Attention may, however, be drawn specially to the narrow beam, long range type (d), which is particularly suitable for floodlighting high buildings at short projection or for long, horizontal throws up to 500 ft. By the aid of the focussing arrangement an angle of 30° with a standard gas-filled lamp or 5° with a Class B type lamp can be obtained.

A somewhat unusual type of "garden fitting," illustrated in a recent list from Philips Lamps, Ltd., is shown in Fig. 13, whilst an attractive floodlighting installation is shown in Fig. 14.

A final reference may be made to some leaflets that have reached us from Messrs. Falk, Stadelmann and Co., Ltd., which contain particulars of a very serviceable range of projectors, flower bed floodlights, and motor-controlled revolving colour weatherproof floodlights, as well as typical Coronation illuminated devices of a type similar to those described above.

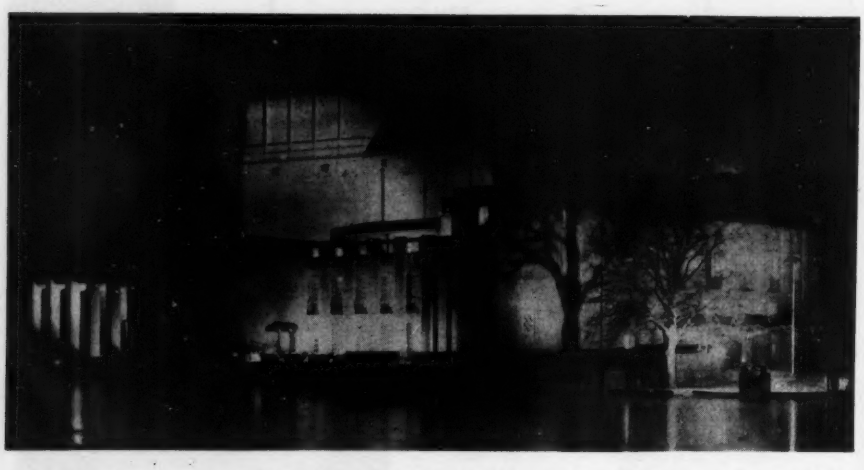
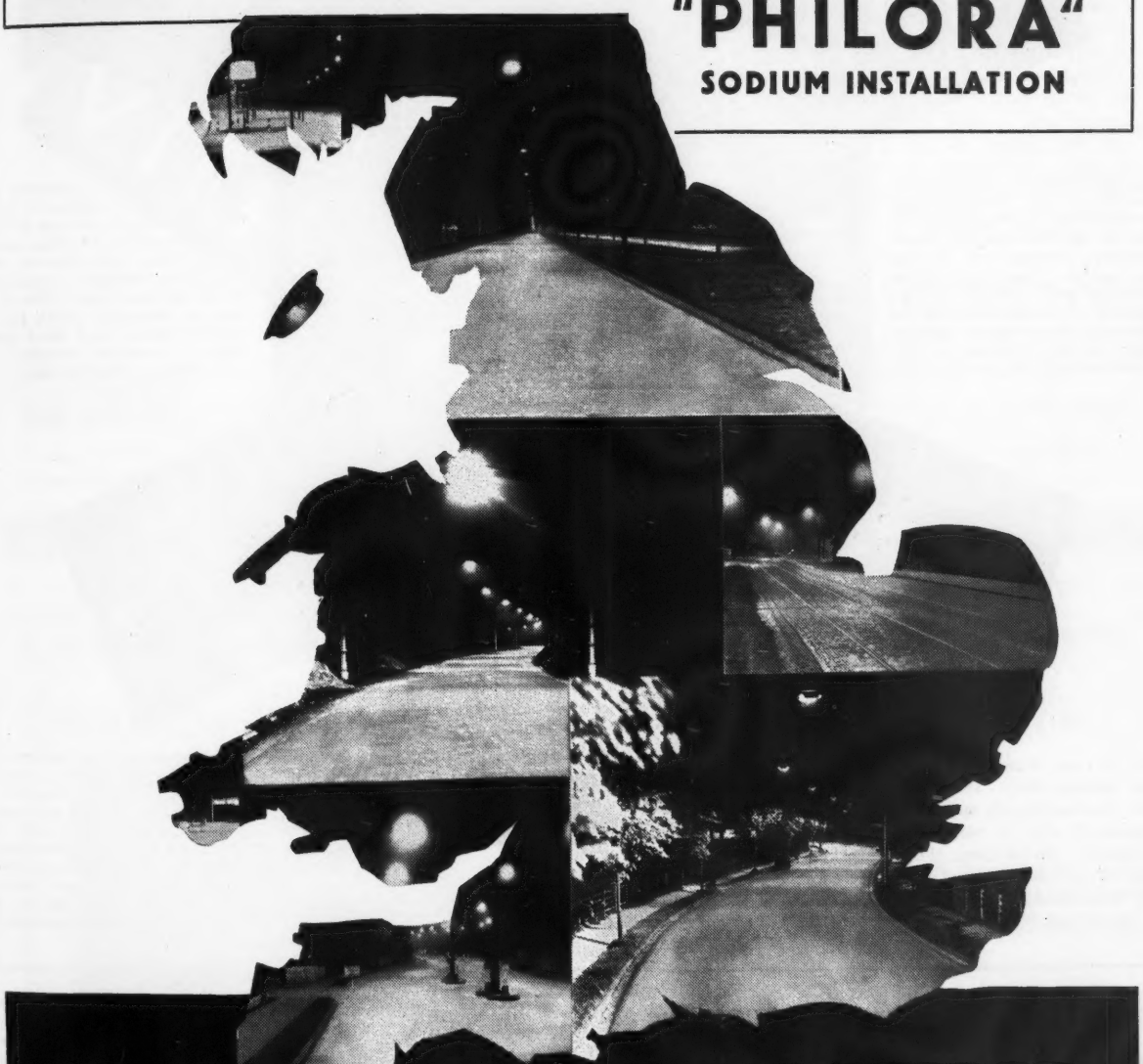


Fig. 14. An attractive Philips flood lighting installation showing the value of water in the foreground.

Fig. 13. A handy form of Philips Garden Fitting.

Every Golden Sodium-lit road in Great Britain is a **PHILIPS**

"PHILORA"
SODIUM INSTALLATION



Four years ago the first "Philora" Sodium installation was put into operation in this country. Today, this soft, golden light is recognised as one of the biggest contributions ever made to night-safety on the roads. There are many "Philora" Mercury lighting schemes, too.

PHILIPS PIONEERED
"PHILORA"
SODIUM ROAD LIGHTING

PHILIPS LAMPS LTD. ("PHILORA" DEPT.), 145, CHARING CROSS ROAD, LONDON, W.C.2
47

Coronation by Gas

Floodlighting in Holland

The accompanying photographs, furnished by the Managing Director of the Municipal Gas Works at The Hague, were recently reproduced in the *Gas Journal*. They illustrate the effective part played by gas lighting in connection with the marriage of Princess Juliana, Heir to the Throne of the Netherlands, in January last.

The "Eternal Fire" consisted of a gas flare consuming about 4,250 cubic feet of gas per hour during the evenings, a smaller flare, consuming about 550 cubic feet per hour, being used for the remainder of the day and night. This is a type of effect for which gas is specially suited—and which provides a complete contrast to ordinary floodlighting.

The pictures illustrate one special feature of gas lighting effects—the production of flares and flambeaux, the animated and "live" nature of which is well adapted to festive occasions. One of these, the "Eternal Fire" lighted by Prince Bernard in the presence of his Royal Bride on Dec. 19, was kept burning day and night until the Wedding Day.

By courtesy of the Gas Journal.

Other special devices utilising gas lighting are illustrated in the pictures. A booklet recently issued by the B.C.G.A. illustrates some of the excellent effects obtained in 1935 and recalls that the running cost, even for a large installation of 30,000—40,000 candle-power, only works out at a shilling or two per hour. Gas undertakings throughout the country should be alert to show what gas can do during the coming Coronation festivities.

Notes on Gas Lighting

Among the gas floodlighting displays announced for the Coronation, the Edinburgh Gas Department is to illuminate the Royal High School and other buildings; in London, St. James's Park will be again floodlighted by gas; at Plymouth, Devonport Park and the Technical College will be illuminated; and at Stoke-upon-Trent the gas and electricity departments are to share in the task of floodlighting the town halls.

The Borough of Lambeth's recent seven-year contract for gas lighting affects a total of 3,780 lamps. Of these, 3,500 are low-pressure lamps and 280 high-pressure. The class of lighting to be installed will conform to the British Standards Specification, Class E, where high power gas lamps are used, and Class F over the remainder of the area. This contract means that the number of gas lamps will be materially increased.

About 250 lamps are involved in the renewal of the Newtownard U.D. Council's agreement for public lighting by gas.

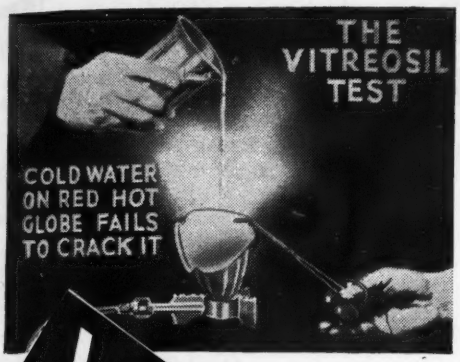
A total of 5,772 gas lamps, with an annual consumption of 90,900,000 cubic feet is in use in Leicester. During last year, sixty-eight additional lamps were erected in housing estates.

In 1926 the amount of gas used for public lighting by the Chesterfield Corporation was 77,631 therms, or 4.3 per cent. of the total sales of gas; last year it amounted to 255,100 therms, or 13 per cent. of gas sales. This represents an increase of no less than 228 per cent., and over the same period the number of gas lamps in use has increased by 62 per cent. These now total 1,534.

The consumption of gas for public lighting in Wallasey has risen from 71,783,000 cubic feet in the year 1931-32 to 99,122,000 cubic feet in 1936-37, an increase of 38.1 per cent.

The Dudley Borough Council recently entered into a seven-year contract for gas lighting in the area under its control. Over 1,300 lamps are affected, and improvements in the lighting will be effected under this agreement.

New contracts for gas lighting have been entered into by the Uckfield Parish Council and the Urban District of Norton, near Doncaster.



ONLY VITREOSIL LIGHTING WARE GIVES THIS MARGIN OF SAFETY

Note the Vitreosil Test. Only Vitreosil Lighting Ware survives this ordeal. Any other lighting glassware, even though it passes the British Standard Specification Test, would be shattered by the shock of sudden cooling from red heat. This means a margin of safety far in excess of the needs of domestic or industrial lighting. It enables Vitreosil Globes, Bowls and Reflectors to be used on high-pressure and super-heated burners without the slightest fear of "flying."

Moreover, smaller shapes can be confidently used, thus concentrating the mantle heat and producing a brighter light which is softly diffused with the minimum loss by passage through Vitreosil.

There is unique beauty in the pearly lustre and satin-like surface of Vitreosil, and the patterns are designed for modern decorative needs.

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Lists on request from the Sole Manufacturers—

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Vitreosil Works, Wallsend-on-Tyne.

London Depot: Thermal House, Old Pye St., S.W.1

GLOBES · BOWLS · REFLECTORS · · OF PURE FUSED SILICA

KANDEM PROJECTORS *for* CORONATION FLOODLIGHTING

A complete range of wide beam and long range projectors are available for hire or purchase.

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KANDEM ELECTRICAL LTD.

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The Illuminating Engineering Society

32, Victoria-street, S.W.1

INDUSTRIAL LIGHTING SECTION

NEXT MEETING

April 21, 1937, at 6.30 for 7 p.m.

On the invitation of the E.L.M.A. Lighting Service Bureau the **next meeting** will be held at 2, Savoy-hill, London, W.C., on **April 21,** when the proceedings will be as follows:—

6.30 p.m.—Light refreshments will be provided.

7.0 p.m.—Mr. W. R. STEVENS, B.Sc., will open a Discussion on **"The Design of Industrial Lighting Fittings in relation to their performance."**

Royal Photographic Society: April 27

We learn that Mr. R. G. Hopkinson will be reading a paper entitled "A New Approach to the Problem of Tone Reproduction" before the Royal Photographic Society on the evening of April 27.

The paper will doubtless be of interest to members of the Illuminating Engineering Society, and the Hon. Secretary will be glad to hear from any of them who would like to attend and to receive tickets.

TRADE NOTES AND NEWS

The New Electric Discharge Lamps

For some time we have been awaiting with interest the introduction of the new small type electric discharge lamps, first shown at the opening meeting of the Illuminating Engineering Society in October last.

On the opposite page we refer to a demonstration of such lamps by Philips Lamps, Ltd. Almost simultaneously we have received details from the General Electric Co., Ltd. ("Osira"), the British Thomson-Houston Co., Ltd. ("Mazda Mercra"), Metropolitan-Vickers Electrical Co., Ltd. ("Metrovick"), and Siemens Electric Lamps and Supplies, Ltd. ("Sieray"). It may be assumed that these small 80-watt and 125-watt will be available from all the leading makers of electric discharge lamps.

The 125-watt type is stated to work at 40 lumens per watt, the 80-watt lamp at 30 lumens per watt, and the light is appreciably whiter than that of standard discharge lamps. Other advantages, emphasised in a note relating to Sieray lamps are (1) the shortening of the time necessary to reach full luminous output, and in the "cooling time" after switching off before restarting, and (2) the fact that the lamps, closely resembling ordinary filament lamps in appearance and size, can be used effectively in many existing fittings for gas-filled lamps. We gather that the lamps can be used on standard a.c. pressures of 200 volts and over, but they must be operated with suitably designed chokes, and are furnished with special three-pin bayonet caps. If desired, condensers can be used to improve the power factor.

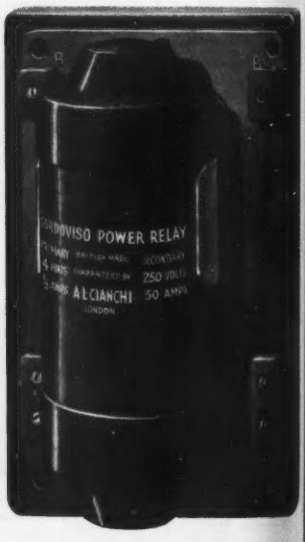
The prices asked for the two lamps (30s. and 35s.) seem moderate for such an outstanding novelty. One imagines that they will find a ready application in streets and in industry, and their range of usefulness should be increased by the possibility of utilising fluorescent outer globes, by which the colour of the lamp can be still further improved.

An effective Philips Coronation Window Display.

Sordoviso Relays and Contactors

Automatic and remote control of lighting has become quite an important subject nowadays, and new and improved devices are constantly making their appearance.

Our attention has recently been drawn to the relays and contactors manufactured by the Sordoviso Manufacturing Company (72, Greencroft-gardens, London, N.W.6), which utilise a unique type of mercury tube, and are stated to be completely free from the drawbacks of so many contactors of the mechanical pattern — gradual deterioration, resulting in noise and humming on a.c. circuits and uncertainty in action. The ingenious method of making contacts makes possible a very robust device which will stand an overload of 100 per cent. without risk of damage. The contacts are sealed in a glass container, and only the very purest mercury is used. The energising current is also remarkably small, only about 6 watts being needed for a rating of 250 volts and 150 amperes, whilst smaller types may need only a fraction of a watt.



This is a device which should be of direct interest to engineers concerned with public lighting, but it has many applications. The firm is also concerned with other ingenious devices, such as the Sordoviso "Silent Bell" system, to which we may have an opportunity to refer on another occasion. We reproduce a general view of a typical power relay, mounted in bakelite cover.

Mr. M. W. Hime, A.M.I.E.E., a member of the staff of the E.L.M.A. Lighting Service Bureau, London, for the past three years, has been appointed district engineer in charge of the E.L.M.A. Scottish Lighting Service Bureau at 29, St. Vincent-place, Glasgow, in the place of Mr. T. Catten, who has resigned to take over another appointment. Mr. Hime has had especial experience in street lighting and electric discharge lamps. He received his early training in the Development Laboratories of the General Electric Company, Witton Works, Birmingham, followed by five years' experience in the test departments of the British Thomson-Houston Company.

The New High-Pressure Lamp

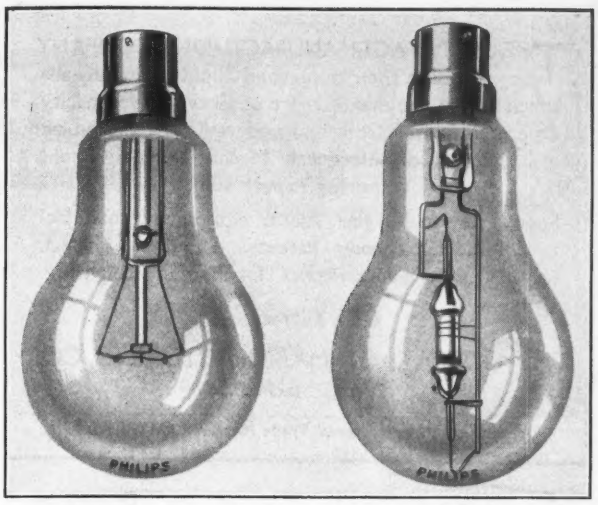
Philips's Demonstration on March 5

On March 5 a demonstration was given to the Press at the showrooms of Philips Lamps, Ltd., at 145, Charing Cross-road, London.

A sketch of recent progress in electric lamps, aided by demonstrations, was given to visitors. Such developments as the tungsten filament, the gas-filled tungsten filament lamp, the coiled-coil filament, and the latest electric discharge lamps were illustrated and described in turn.

This led up to the chief exhibit—the new super high-pressure "Philora" mercury discharge lamps, which in dimensions resemble the ordinary filament lamps (see attached illustration), but have all the advantages of the high efficiency of the discharge lamp. Two lamps, both air cooled, were on view. The 80-watt lamp emits 3,040 lumens and the 125-watt lamp 5,000 lumens, being thus equivalent to the output of 200-watt and 300-watt gas-filled tungsten filament lamps. The discharge occupies a space of only 5-8 in. by 1-16 in. The bulbs are internally frosted and comparable in size to 150-watt and 200-watt lamps of the ordinary type.

Some striking demonstrations of X-ray work were also given. One was interested, for instance, in the very compact foot-operated device for the use of boot-makers and the efficiently protected tubes for medical work now available.



(a) Coiled Coil Lamp (introduced in 1934). (b) The new 80 watt high pressure mercury lamp.

PHILIPS LAMPS DEMONSTRATED TO THE PRESS ON MARCH 5th.

Lighting a Motor Car Works

We are informed that Simplex reflectors were used for the lighting of the Standard Motor Works, Coventry, which was the subject of an illustrated article in our last issue.

Imposing Floodlighting

We are indebted to Floodlighting and Fittings, Ltd., for the above picture showing the effective illumination of the premises of the Eagle Star Insurance Company in Threadneedle-street, London, E.C. For the main elevation to top cornice three banks of floods mounted at ground level were used. Each bank consisted of four "Model D" units, three with 1,000-watt lamps and one with a 500-watt lamp.

Lighting in the Chair and Furniture Industry

The attention of readers may be drawn to a somewhat unusual and enterprising publication of Benjamin Electric, Ltd., dealing with the above subject. This is based on an actual investigation conducted at High Wycombe last year. Of special interest are the plans showing the positions of units in rooms devoted to certain processes and the special methods of lighting applied to belt sanders, spraying booths, etc.

Modern Gas Lighting

Modern methods in gas lighting are well illustrated in several illustrated leaflets issued by Foster and Pullen, Ltd. The "Super" floodlight, with a horizontal row of mantles equipped with reflectors, well adapted for lighting large vertical surfaces, are familiar and have done good service for floodlighting. The "Showray" lamp for interior lighting equipped with an efficient reflector, to which colour filters in red, blue, green, or amber may be added, should meet a long-felt want.

Torquay Market in which a system of modern gas lighting has recently been introduced.

THE CORPATACT MANUFACTURING COMPANY beg to advise their numerous Clients that they are specialists in the manufacture of all types of Capacity Operated Switch Gear, and undertake the design and manufacture of Electrical Mechanical equipment requiring expert staff.

Specialists in Burglar Alarm equipment, manufactured under our own Patents. Enquiries invited. Capacity operated switches for Window Lighting.

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A POWERFUL ROBUST SELF-SUSTAINING WINCH

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DIRECT DRIVE AND RATIO PATTERNS

Will not run back. No wheels to get caught in. Sizes to 10 cwt. smallest wall space, side or front driving, also special types including multi-division barrels, combined horizontal and vertical operation.

Architectural Tour in Russia

We have received from Mr. W. G. Raffé particulars of a trip to the Soviet Union in August next. Whilst the tour has special reference to art and architecture, opportunities will also be afforded to those interested in the decorative aspects of illumination to see notable installations and to visit generating stations and factories producing electrical apparatus.

The party will leave London on July 28 and proceed by sea for four days to Leningrad. Those taking the three-week tour will return by Wednesday, August 18; those who take the four-week trip, with extension to Kharkov and Kiev, by August 25. The inclusive cost (travel by ship and train, hotels, and all necessary items) will be twenty-five guineas for the three-week tour and forty guineas for the full four-week period.

The attention of members of the Illuminating Engineering Society and friends is drawn to this trip by Mr. W. G. Raffé, who is himself a member of the Society. The party will be under his guidance, and he will endeavour to ensure that any members who take part see the places of special professional interest to them—provided that they make their desires known in good time for the necessary permits to be obtained. Those interested should communicate with Mr. Raffé (56, Gloucester-crescent. N.W.11), from whom fuller details may be obtained.

Rawlings Brothers' Social

On March 20 Messrs. Rawlings Bros., Ltd., entertained no fewer than 700 guests—their employees and womenfolk—to a social evening at Derry and Toms. Mr. W. R. Rawlings—a leading and highly respected member of the Illuminating Engineering Society—presided. In the course of a brief speech, he referred to the presence of Mr. Freddie Smith, who was the first boy engaged by the firm fifty-one years ago, when it was founded by his brother, Mr. John Rawlings, and himself. To-day the staff of Rawlings Bros., Ltd., totalled 400—and, if all associated and subsidiary firms had been included, the number present (700) would have been swelled to over 2,000, too great to be accommodated in any hall in Kensington, except the Albert Hall!

It need scarcely be said that the evening was a most enjoyable one, and that the event was voted an outstanding success.

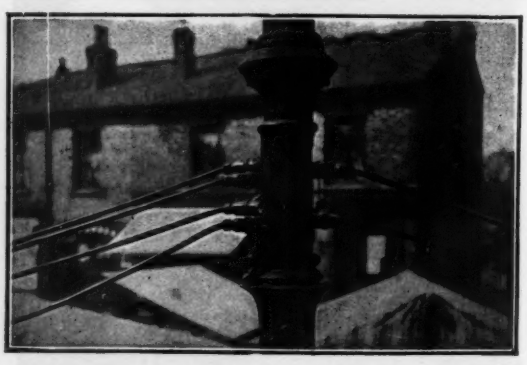
SITUATIONS VACANT

Draughtsman required for Reflector Fittings and Electrical Accessories for Industrial Lighting Equipment. Practical man for layout and details for works drawings. State experience, age, and salary required. Write Box 109, "Light and Lighting," 32, Victoria-street, London, S.W.1.

Contracts Closed

THE BRITISH THOMSON-HOUSTON CO., LTD.:—

Twelve-month contracts for the supply of Mazda lamps have been secured from the Metropolitan Borough of Islington, the County Borough of Great Yarmouth, the London and North-Eastern Railway, and the County Borough of Belfast, Tramways Department.



A "Niphan" market lighting installation, showing main feeding sockets fitted to a lamp standard.

MARKET LIGHTING with the NIPHAN System

FOR some years we have been collaborating with public lighting authorities in devising temporary lighting installations for market stalls. The picture shows part of a "NIPHAN" market job, in which 6 sockets, in conjunction with a fuse board, were mounted on a lamp standard, with plugs leading to 3-way tees and suspended through sockets.

● Our extensive market lighting experience is at your disposal.

Announcement of SIMMONDS & STOKES Ltd., Victoria House, Southampton Row, London, W.C.1. Tel.: Holborn 8637. 'Grams: "Niphon, London."

NIPHAN

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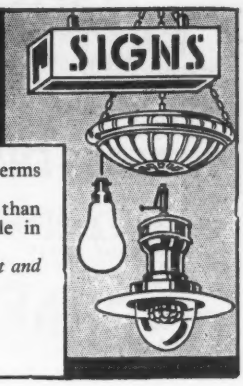
A DIRECTORY OF LIGHTING EQUIPMENT



We invite applications for spaces in this new section of the journal. Particulars of terms for each space (approx. 1 inch deep and 3⅛ inches wide) are given below.

These terms are equivalent to **half our ordinary advertising rates**, but not less than 12 successive monthly insertions can be accepted on this basis, and amounts are payable in advance.

Payment for an advertisement in this section entitles the advertiser to receive *Light and Lighting* during the period of the contract.

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Theatres and Public Halls. Tennis and Racquet Courts.
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Our Illuminating Engineers will be pleased to advise you on any street or floodlighting problem

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Seamless Steel Lighting Standards

for all requirements

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CONCRETE UTILITIES, Ltd.

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SILVERED GLASS REFLECTORS

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500/1000 Watts
Model "B"

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make all types of Lanterns for Street Lighting
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Samples for trial willingly sent—we invite comparison on both cost and quality
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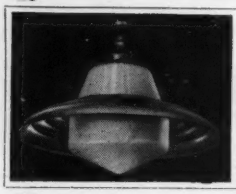
25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Selenium Layer Type (Brit. Pat.) round or Rectangular, for all kinds of light-sensitive apparata.
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SPECIALISTS IN COLOUR LIGHTING and STAGE EQUIPMENT
LIGHTING FOR EVERY OCCASION
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ELECTRIC LAMPS of all types. "SIERAY" ELECTRIC DISCHARGE LAMPS. ELECTRIC LIGHT FITTINGS. FLOODLIGHTING APPARATUS. SHOP-WINDOW LIGHTING EQUIPMENT. STORE LIGHTING. INDUSTRIAL LIGHTING, CINEMA LIGHTING, ELECTRIC SIGNS, ETC.

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PLUGS, SOCKETS, TEES, COUPLINGS, TERMINAL SOCKETS AND JOINT BOXES
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When you want the best!
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LIGHTING FITTINGS
TROUGHTON & YOUNG LTD.
143 KNIGHTSBRIDGE

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WORKSLITE REFLECTORS. WARDELYTE GLASSWARE
PRISMALUX DIRECTIONAL UNITS.

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"PHOTRONIC" Photo-electric ILLUMINATION METERS BY WESTON

Siemens Floodlighting at the Coronation

We learn that Messrs. Siemens Electric Lamps and Supplies, Ltd., will be responsible for the floodlighting of the following during the period of the Coronation:

"Big Ben"; Mansion House; Guildhall; Monument; Tower Bridge; Quarter Sessions House, Newington Causeway; Australia House; R.A. Club; Incorporated Society of Accountants, Victoria Embankment; Middlesex Guildhall, Westminster; St. Dunstan's, Eastcheap; St. Bride's, Fleet-street; St. Dunstan's, Fleet-street; St. Mary's, Bow-lane; Bow Church, Cheapside; St. Paul's, Hammersmith; St. Michael's, Wood Green; Westminster Bank, Orchard-street, W.; Lloyds and National Provincial Foreign Bank, Haymarket; Town Hall, Birmingham; Handsworth Park, Birmingham; Royal Fort, Bristol; St. Stephen's Church Tower, Bristol; Lister and Co., Ltd., Manningham Mills, Bradford; Shipley Art Gallery, Gateshead-on-Tyne.

Electric Street Lighting

Banff.—Fifty mercury discharge lamps are included in Banff's new scheme of 135 electric lamps, the first section of which is now in commission.

Billingham-on-Tees.—At a cost of £393, mercury discharge lamps are to be erected on the new Belasis Bridge and approaches, forming a complement to the nearly complete £15,000 all-electric street lighting scheme.

Chatham.—74 mercury discharge standards and lanterns are included in a tender accepted by the Council.

Dover.—Trials of various mercury discharge lamps are being made in the Market-place.

East Ham.—The borough council has received instructions to borrow nearly £8,000 for mercury discharge lighting on the main road.

Eccles.—£1,000 is to be expended on electric lighting.

Jarrow.—A £1,185 scheme has been approved by the council for forty-two 150-watt sodium discharge lamps in York-avenue.

Southwark.—For improved street lighting in the borough, £6,168 is to be spent, a considerable part of which will be devoted to the East-street mercury discharge lighting scheme.

Swansea.—Sodium discharge lighting is proposed for all main traffic routes; and is included in a contemplated expenditure of £20,000 on street lighting.

Bristol.—3,550 modern electric lamps will be required if the council adopts the plans now under consideration, involving an expenditure of £120,000. Existing lamps to be replaced by electric discharge lamps, total 360 kw., which will be increased to 540 k.w. or 900 k.w., according to whether 150-watt sodium or 250-watt mercury lamps are installed.

Barking.—A tender for the provision of 120 mercury discharge lamps for Barking By-pass-road and River-road, has been accepted by the Council. In 3 ft. 4 in. positions columns will carry two lamps.

Windsor.—The Council has approved a scheme for mercury discharge lighting in the principal streets in the borough.

Newport (Mon.).—The main road has been entirely relighted. Fifty-eight 1,000-watt lamps and thirty 500-watt lamps are being used. Excellent results are obtained with an average spacing of 45 yards, staggered, 23 ft. 6 in. mounting height, 3 ft. overhang.

Contracts Closed

THE GENERAL ELECTRIC Co., LTD.—*L.N.E. Railway C... L.M.S. Railway Co., Belfast, and Belfast Mem... Hospital,* for twelve months' supplies of Osr... lamps.

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"LUX"

(La Revue de l'Eclairage)

WE have pleasure in announcing to our readers that we have entered into an arrangement to receive subscriptions for the French Journal "Lux" (La Revue de l'Eclairage). The subscription per annum is 30 francs, the approximate equivalent of which in English money is Seven Shillings and Sixpence (7/6).

"Lux" is the only French journal which specialises in all aspects of Lighting; it is the official organ of the Association Française des Ingenieurs de l'Eclairage (equivalent to the Illuminating Engineering Society in France).

It furnishes a complete record of interesting developments in lighting in France and on the Continent. It is fully illustrated and in particular devotes a considerable number of its pages to Decorative Lighting.

By studying these articles and the numerous photographic reproductions of modern lighting installations the reader can readily gain an excellent impression of French methods and practice in matters of Illumination.

Applications for subscriptions will be received by "Light and Lighting," 32, Victoria Street, London, S.W.1.

IMPORTANT NEW GAS LIGHTING CONTRACTS FOR LONDON

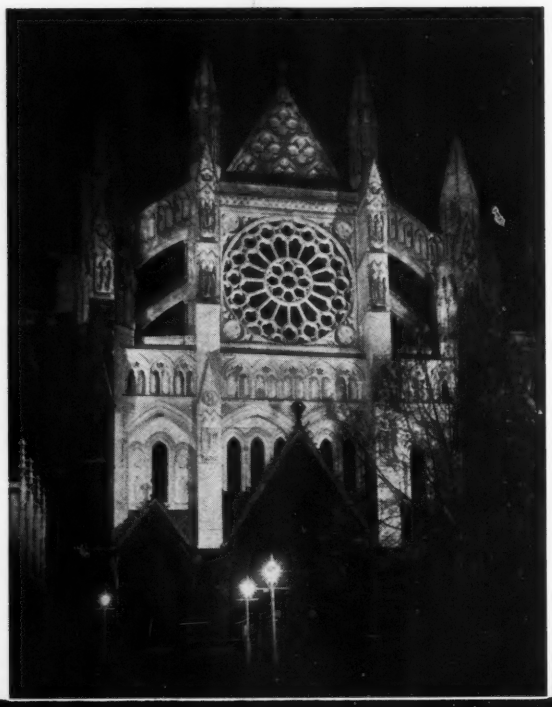
Westminster, Holborn, Paddington, Southall-Norwood—and now Chelsea. The list of 15-year contracts embodying gas for street lighting in London boroughs is steadily growing. Chelsea's new agreement affects the lighting of the side streets in the Borough and that on thirteen main traffic routes. By the addition of special reflective devices and the raising of the candle power of existing lamps, the illumination of all side streets will be doubled; while the lighting of the main roads will be brought up to the standard laid down by the interim report of the Ministry of Transport Departmental Committee on Street Lighting.

Another important contract signed for gas lighting in London affects about 106 miles of roads in Wandsworth. The agreement is for a period of 5 years and the system employed will be high-pressure gas lighting for main roads and low pressure for the remainder. The new lamps are to be installed at the rate of 270 a week until the remodelling of Wandsworth's lighting is completed. About 5,000 modern gas-lamps will be fixed under the scheme of modernisation.

Among the many 1935 and 1936 contracts which specify the use of gas for public lighting may be mentioned the following:—

15-YEAR CONTRACTS:	*Southall-Norwood, Whitstable, Hendon, Dagenham.*
10-YEAR CONTRACTS:	*Ruislip-Northwood, Ilfracombe, Cambridge, Blyth, Northampton, Southwark, Penge, Margate.*
7-YEAR CONTRACTS:	*Harrow, Wanstead-Woodford, Farnhill, Brightlingsea, Selkirk, Hatfield.*
5-YEAR CONTRACTS:	*Welshpool, Budleigh Salterton, Deal, Wembley, Brentwood, Falmouth, Walton-on-Thames, Diss, Egham, Kidwelly.*

ISSUED BY THE BRITISH COMMERCIAL GAS ASSOCIATION, GAS INDUSTRY HOUSE - 1, GROSVENOR PLACE, LONDON, S.W.1.



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Well designed schemes call for the service of experts who can apply this new science of decorative lighting in an æsthetic form to suit the environs.

To effectively meet all requirements an extensive range of floodlights such as HOLOPHANE offer is an essential.

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FREE ADVISORY SERVICE OF EXPERTS

is available to assist you with schemes for your CORONATION FLOOD-LIGHTING.

HOLOPHANE Prismatic Units incorporate special reflectors which combine high efficiency without depreciation.

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Write for our new Floodlighting list :

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LONDON - S.W.1

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